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May 2012 • US$33*
The International Magazine for the Wire & Cable Industries

WIREexpo 2012

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Dr. Torben Clausen, R&D at SIKORA AG

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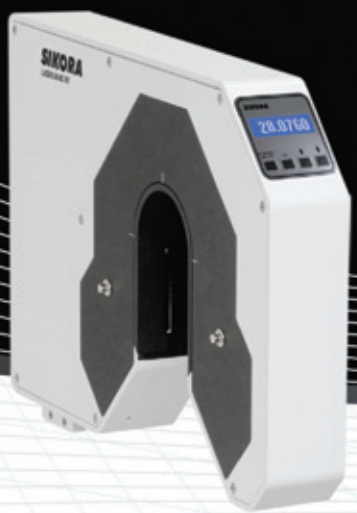

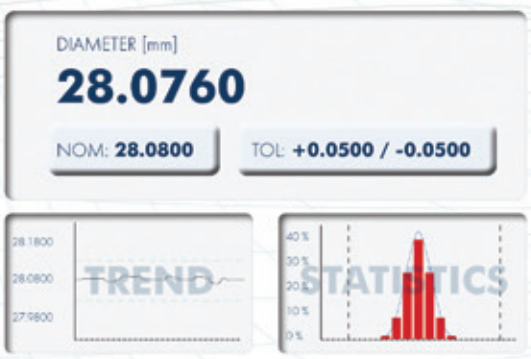

During the production of wires and cables the LASER Series 6000 measures the outer diameter in a range from 0.2 to 78 mm. The high measuring rate of the gauges allows at the same time a detection of lumps and neckdowns.

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Jean-Paul Sartre

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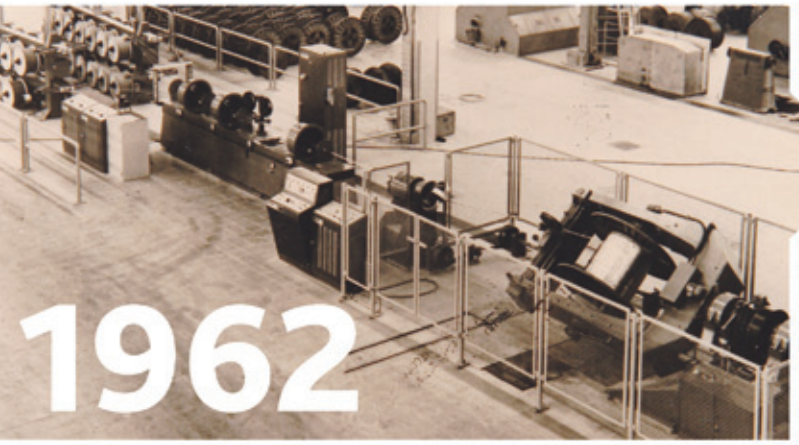
FOR 50 YEARS AND COUNTING

2012 will commemorate our accomplishment of 50 years of successful business



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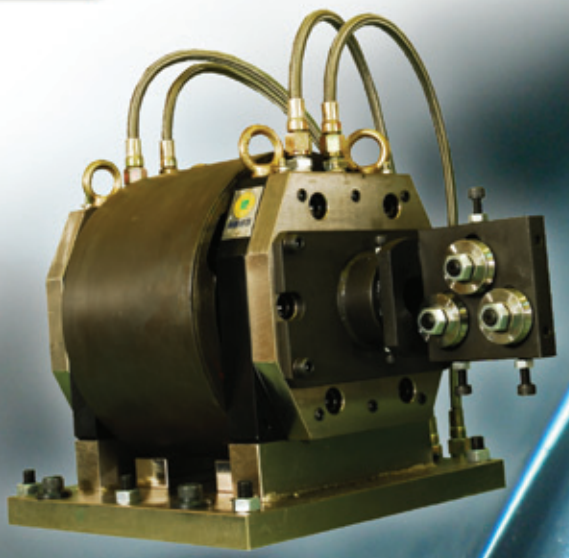
50 ANNIVERSARY 1962-2012

www.omlesmo.com

NEW DRAWING AGE
- Roller Cassette



The Roller Cassette uses the rolling movement to reduce friction, having 10 times less friction than traditional die box. Less friction and achieving the same goal.

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TAIWAN OFFICE: NO.38 BENGONG DON 2ND RD., GANGSHAN TOWN, KAOHSIUNG COUNTY 82059, TAIWAN
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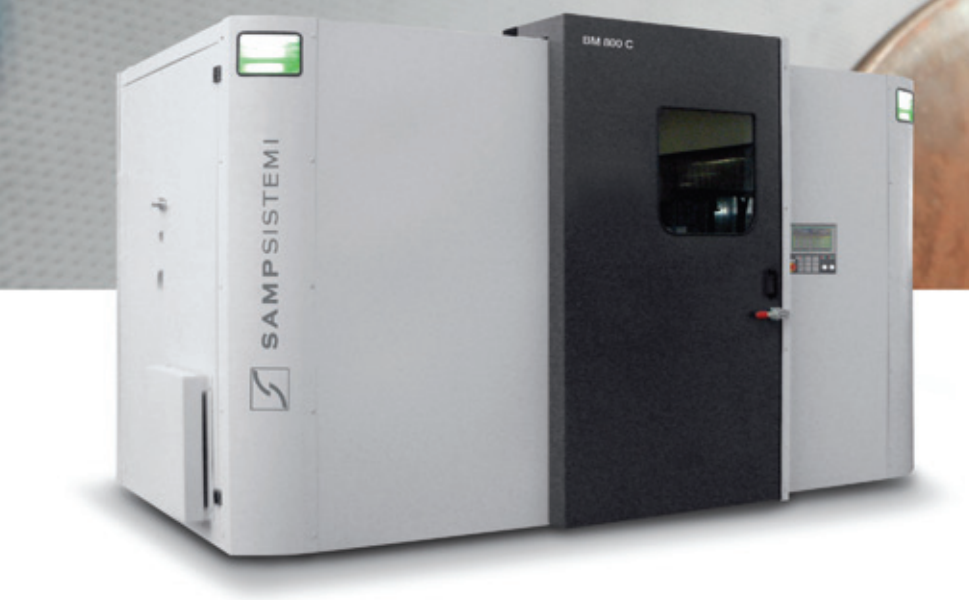
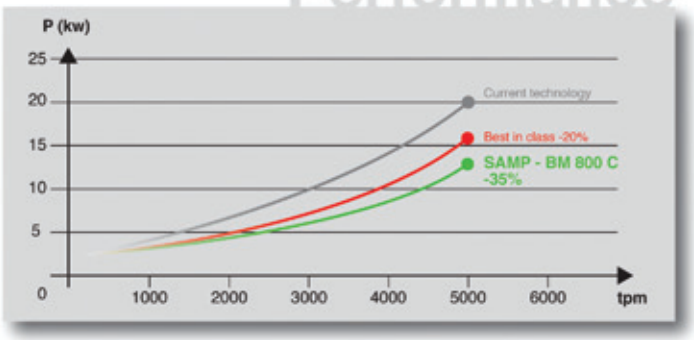
SAMPSISTEMI

BM 800 C
Double-twist bunching machine



Performance



The new BM 800 C is a high-performance and innovative double-twist bunching machine. In-depth tests carried out in real working conditions show a decrease of energy costs by up to 35% compared to traditional machines.

www.sampsistemi.com

**** US$33 purchase only***
Front cover: Sikora AG
See page 104 for further details

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Getting wired up to beat the criminals

Metal, wire and cable theft has been a hot topic for quite some time. Figures released recently show that in Britain alone it costs to the tune of £770m every year.

As you can imagine it has become quite a target for our authorities. It is then encouraging news that the Association of Chief Police Officers has recommended the Alarmed and Traceable Technology Solutions System developed by PID Systems. (See page 9).

This system – for use in remote locations – sounds an alarm, sends a signal to the owner of the building and PID Systems, and films any attempted theft on video.

To further bolster its resources the system is vandal resistant and coats would-be thieves with an encrypted marking agent that links them directly with the crime scene.

Now anything that cuts down on the thefts has to be viewed as good, not just for the cable or metal owners, but also the general public.

When thieves took just 30ft of cabling from the side of a track in London, UK, it caused 1,650 trains to be delayed at a cost to Network Rail of £640,000.

It's not just the financial impact of that in terms of the theft directly. Imagine people on 1,650 trains being delayed. The cost to the economy in general must be frightening.

On to brighter things and the resounding success that was wire 2012. Everyone I spoke to had nothing but praise for the show and its organisers, Messe Düsseldorf.

Optimism, it appears, translated into firm orders for companies around the world, emphasising again the importance of the show.

It was also good to put faces to names and I'd like to thank everyone for the warm welcome we received.

David Bell
Editor

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contents

Wire Expo 2012 • Onmi Dallas Hotel

Market News

Deutsch Inhalt

Содержание на русском языке

Technical Articles

Next Issue

Features On

- Cable sheathing, armouring and taping material & machinery
- Focus on Turkey/Greece
- 15th Anniversary Issue

Getting Technical

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bigstockphoto.com – "Dallas skyline at dusk" by Brandon Seidel

Wire Expo 2012

22-23 May: **Wire Expo** – trade exhibition – Dallas, USA
Organisers:
Wire Association International
Fax: +1 203 453 8384
Email: info@wirenet.org
Website: www.wirenet.org

2012

June 2012

19-21: **Guangzhou Wire and Tube** – trade exhibition – Guangzhou, China
Organisers:
Julang Exhibition Co Ltd
Fax: +86 203 862 0790
Email: meiwen@julang.com.cn
Website: www.julang.com.cn

September 2012

25–28: **wire/Tube China** – trade exhibition – Shanghai, China
Organisers:
Messe Düsseldorf China Ltd
Fax: +86 216 169 8301
Email: www.shanghai@mdc.com.cn
Website: www.mdc.com.cn

October 2012

30–1 Nov: **wire and Cable India/ Tube India** – trade exhibition – Mumbai, India
Organisers: Messe Düsseldorf India
Fax: +91 112 697 1746
Email: info@md-india.com
Website: www.md-india.com

November 2012

11-14 Nov: **IWCS** – Technical conference & trade exhibition – Providence, RI, USA
Organisers:
IWCS Inc
Fax: +1 732 389 0991
Email: phudak@iwcs.org
Website: www.iwcs.org

2013

April 2013

23-25 April: **Interwire 2013** – trade exhibition – Atlanta, USA
Organisers: WAI
Fax: +1 203 453 2777
Email: info@wirenet.org
Website: www.wirenet.org

May 2013

TBA: **wire/Tube Russia** – Technical conference & trade exhibition – Moscow, Russia
Organisers:
Messe Düsseldorf GmbH
Fax: +49 211 456 07740
Email: info@messe-duesseldorf.de
Website: www.wire-russia.com

DNA technology in bid to beat the thieves

▲ *Remote technology is a major step forward in beating metal theft*

A REVOLUTIONARY, portable alarm system that can film thieves and link them to crimes using DNA technology in remote locations has been hailed by police as a major step towards helping to combat a massive rise in metals theft.

The Alarmed and Traceable Technology Solutions System (AATTS), developed by Kilmarnock, Scotland-based PID Systems, is the first purpose-built alarm system for protecting vulnerable properties and locations to be approved and recommended by the Association of Chief Police Officers (ACPO).

The system is wireless and so doesn't need to be connected to a mains supply and it can be installed quickly and easily. As well as sounding when an intruder is detected, it sends a signal to the owner of the building, to PID Systems and it also captures any attempted theft on video.

The vandal-resistant device is used in conjunction with an indelible red ultraviolet (UV) dye, which can only be seen under UV light. It coats intruders with a unique, encrypted molecular marking agent that can be linked back to the crime scene.

Jacqui Shiel, development manager for ACPO's Secured by Design initiative, said: "Metal theft is a growing problem which can be very expensive to address, both in the cost of replacing materials taken and in effecting repairs. Early notification of a potential problem is very important in preventing this disruption and identifying those responsible.

"PID Systems' AATTS is an effective weapon in the fight against metal theft because it can be deployed quickly and easily in a wide variety of internal and external locations. It uses the latest technology to provide an adaptable early warning and detection system.

"Secured by Design focuses on the prevention of crime within homes and commercial premises. This police initiative also licenses products that meet current security standards or products of a specialist nature that have been independently evaluated."

There has been a massive rise in metals theft, prompted by a hike in global cost. The price of copper rose from £889-a-tonne in November 2001, to a high of £6,356-a-tonne, recorded last year. According to HM Revenue and Customs, an estimated 10,000 incidents of metal theft every year costs the UK economy more than £5.6billion in lost revenue.

Among those hardest hit by copper theft is Network Rail, which saw the number of railway cable thefts rise by 65 per cent, leading to 16,000 lost working hours, between 2009 and 2010, and BT which has seen a 12 per cent rise in cable thefts in the past year.

Graham Jones, the MP for Hyndburn, has introduced a private Metal Theft Prevention Bill in the House of Commons that seeks to tighten regulation, including a robust licensing scheme for scrapyards. Separate legislation is to be introduced in Scotland.

PID Systems – UK
Website: www.pid-systems.co.uk

Council's flagship all lit up

MODULAR Wiring Systems, a subsidiary of electrical cable manufacturer Tratos Ltd, has designed, manufactured and supplied modular power and lighting distribution systems for Birmingham City Council's new flagship workplace.

Birmingham City Council's new 10 Woodcock Street office, located next to Aston University, is the council's largest single investment in a new staff workplace in over a century and boasts seven sustainability features, including rainwater harvesting and a brown roof for wildlife. It will be home to 2,200 fixed desks over five storeys together with a further 500 "touchdown" work areas within the building to enable maximum flexibility of the space.

Modular Wiring Systems has designed, manufactured off site and supplied multi-functional power and lighting distribution systems with standard Point-to-Point and switching and DALI control for the new offices.

Unlike standard builds where the distribution systems are installed from the bottom up with cables running under false ceilings, the Woodcock Street office installation has been a top to bottom installation.

Power is fed from above and cables have been run through raised flooring as there are no false ceilings. The second floor was a particular challenge, with all cabling fed under an acoustic canopy.

▲ *Birmingham City Council's new offices*

As a result of the unusual design, flexibility of products and method of installation was vital, which Modular Wiring Systems was able to meet with ease. In fact, so intuitive are its systems to install that the contractor on the project, who had never installed a prefabricated distribution system before, was able to undertake the work with minimal training in a very short space of time.

This speed of installation was vital due to the extremely tight schedule and completion date.

Modular Wiring Systems – UK
Website: www.modularwiring.com

Cables increase crane lift and outreach

Heavy lift and transport specialist BigLift Shipping successfully completed the first job with its new super fly jib. Initiated by Huisman, the first ever super fly jib was equipped with special Twaron stay cables to lengthen the crane to a radius of 55 metres. The aramid fibre Twaron is lightweight and five times stronger than steel. This results in a reduced installation time while enabling an increase in lifting height and outreach during heavy lifting activities.

By using Teijin Aramid's fibre Twaron in FibreMax stay cables, 'Happy Buccaneer's' new super fly jib extends the crane to a maximum lifting capacity of 350 metric tons at 35 metres outreach. The maximum outreach and height of the heavy lift crane are increased by 50%.

The Twaron stay cables have a rated minimum breaking strength of 920 metric tons. Specialist in lifting, drilling and subsea solutions Huisman designed and manufactured the crane and the super fly jib, equipped with Twaron stay cables. They are produced by FibreMax for BigLift's heavy lifting carrier 'Happy Buccaneer'.

Gem Wender, project engineer at BigLift: "The specifications and conditions of Twaron exemplify the suitability of these fibres for heavy lift applications. Because of the strength, flexibility and light weight of Twaron stay cables, we were able to significantly shorten and simplify the installation of the super fly jib on the 'Happy Buccaneer'".

The properties of Twaron aramid fibres used in FibreMax stay cables ensure a number of significant advantages. Twaron stay cables offer smaller diameters, less weight and higher strength, resulting in major advantages in terms of easier handling, increased safety, faster operations and downsizing of constructions. Besides its strength and flexibility, Twaron offers long-term stability and performance. It is resistant to severe weather conditions, sustainable, and characterised by thermal stability.

Christoph Hahn, director marketing and sales of Teijin Aramid, said: "We are proud to be in the position to support BigLift, Huisman and FibreMax by applying Twaron in their heavy transport lifting stay cables. Twaron is a super strong fibre offering many fantastic technical features with which our customers can create many new innovations on top of the many existing applications. We are happy to share our knowledge about aramid to help our customers to develop new great products."

This is the first time that an aramid fibre such as Twaron has been used in a marine heavy lift crane application that complies to the requirements of Lloyd's Register as specified in Lloyd's 'Code of Lifting Appliances in a Marine Environment'.

Teijin Aramid – Netherlands
Website: www.teijinaramid.com

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Keeping the transport system flowing

NEW Belden Railway Approved Gigabit Ethernet data cable BE43800 offers fast, reliable communications and enhanced system performance in railway, transportation and city transit systems.

Belden® BE43800 is a halogen-free Cat 5e Ethernet cable that meets the highest railway industry standards. This highly specialised data cable reliably delivers real time information for operators and passengers, on-board as well as in terminals and control rooms.

This new Belden® industrial Ethernet rail cable is particularly suitable for use in Gigabit Ethernet networks in rolling stock onboard applications for monitoring, recording and control systems; multimedia passenger information and entertainment; and train control management systems.

For safety and security, BE43800 Belden cable is approved to international railway standards.

Introducing the new cable, Louise Wild, product manager, said: "This Gigabit Ethernet data cable is highly suited for use in the rail passenger transport industry to support expanding communications networks.

"Increasingly, passengers demand improved comfort and safety on board trains. They require actual travel-related information such as arrival times, connecting points and multimedia services including Internet access and infotainment. The shift to Gigabit Ethernet facilitates all these and future services."

Belden – Netherlands
Website: www.belden.com

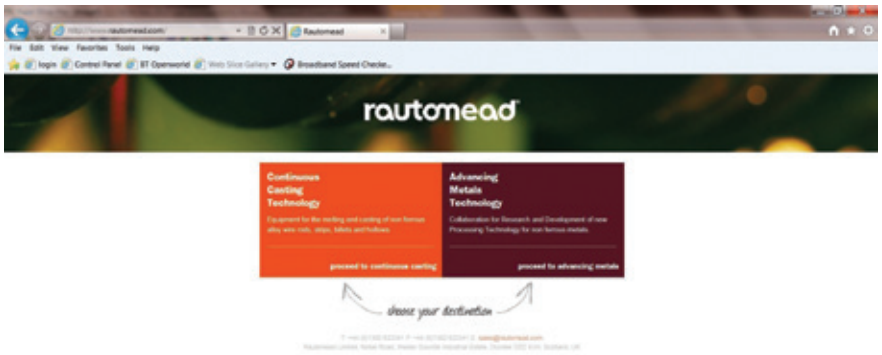
Furnaces up and running

A few years ago, Tenova LOI Italimpianti and Tenova Hypertherm were awarded a contract for two Roller Hearth Furnaces for Tata Steel's Thin Slab Casting & Rolling plant (TSCR) in Jamshedpur, India.

In December 2011 the dry-out was carried out successfully and the hot trial will start very shortly.

The second furnace, now in advanced stage of erection, was scheduled to be completed during the first quarter of 2012.

Tenova – Italy
Website: www.tenovagroup.com



▲ *A snapshot of the new Rautomead home page*

New web presence for Rautomead

CONTINUOUS casting technology specialist Rautomead Limited of Dundee, Scotland, has launched a new website to reflect the changes that have transformed the company in recent months.

Rautomead's 2011 launch of an entirely new division within the group, 'Rautomead Advancing Metals Technology', has dictated a new structure for the site, which now falls into two distinct, and easily navigable, parts, 'Continuous Casting Technology' and 'Advancing Metals Technology'.

The 'Continuous Casting Technology' side of the site showcases the company's established continuous casting equipment and technology for non-ferrous metals applications, including copper wire and cable, alloy wire, engineering alloys, precious metals, copper magnesium and turnkey projects, while the other half of the site focuses upon the exciting new developments taking place within the company's new 'Advancing Metals Technology' division.

Rautomead – UK
Website: www.rautomead.com

Tratos in full colour

Cable manufacturer Tratos Cavi has produced a colour booklet celebrating the Valtiberina valley in Tuscany where it has operated its manufacturing facility for over 40 years.

The 32 page 'Discover Valtiberina' guide explains the geology, flora and fauna of this picturesque valley, along with the human history dating back to the Palaeolithic period through the Bronze Age, Etruscan and Romans, Renaissance and right up to the present day.

It examines the impact man has had in the region, including the building of the Montedoglio dam, as well as the many towns and villages, the most notable of which is the ancient town of Pieve Santo Stefano.

As you might expect, local cuisine and craft feature in the guide, including dishes typical of the region, lace making and cigar production.

Whilst the region is steeped in history, the Valtiberina valley is very much in the present day. The valley is home to a number of industries, the largest of which is Tratos, which has two manufacturing plants employing 300 people, with a turnover well in excess of €120 million.

The new 'Discover Valtiberina' guide has been a labour of love for Dr Maurizio Bragagni, export manager of Tratos: "Tratos is a family owned business and we are proud of our cultural heritage and the beautiful setting of the valley. We want to encourage visitors to the area and help local businesses in the process," he said.

"We hope the guide helps in achieving that by showing the highlights, whether it be the regional cuisine and local crafts, the scenery or some of the many festivals we are home to."

Tratos Cavi – Italy
Website: www.tratos.it

New ownership for AEI

AEI Compounds Ltd, in Sandwich, Kent, UK is now part of the Saco Polymers group of companies following the change of control in July 2011.

The new ownership brings with it a fresh new philosophy and a significantly increased development capability.

The recent wire 2012 exhibition was the first chance for AEI to show off its new image and the well-respected Pexidan range from Saco Polymers, as well its own expanding range of crosslinkable and thermoplastic compounds for the wire and cable industry.

New and important developments within the range of zero halogen products are compounds that form a hard ceramic char for fire alarm and emergency lighting cable, possess superior oil resistance coupled with cold temperature performance for transport applications and flexible compounds for appliance wiring.

At the same time developments continue in improving the range of highly successful thermoplastic compounds for armoured cables used in hot climates with improvements in crack resistance and smoke evolution and as required for LPCB approval.

Backed by the company's excellent reputation for quality, service, innovation and depth of experience in the cable industry, AEI Compounds continues to offer assistance to companies either through attendance at trials or modification of its compounds to suit customers' equipment and final application.

AEI Compounds Ltd – UK
Website: www.aeicompounds.com

Investment to streamline manufacturing

Hutchinson Engineering of Widnes, Cheshire, UK, is investing more than £500,000 in new technology to streamline its performance in manufacturing mobile phone masts and wind turbine structures.

The new Ficep equipment will speed up the fabrication and cutting process by generating quality parts for better fit and less welding time.

This new machinery will allow the company to manufacture larger wind turbines – 50kW and 100kW models – with added ease. It will also improve manufacturing lead times for the production of base plates for telecommunication masts, designed for O2 and Vodafone.

Hutchinson Engineering – UK **Website**: www.hutchinson-engineering.co.uk

Special sizes from GMP

GMP Slovakia produces metal reels, drums and special equipment, including many different items such as drums for twisting, stranding and plaiting.

For planetary stranding the suitable reels are two types: SW-single wall and DW-double wall. The choice of the reel depends on the customer's request and on material to be wound (copper, steel, aluminium wire). DW-double wall is manufactured with two flanges, one flat and one pressed, a design which increases the resistance of the reel after many windings.

For single twist of large dimensions the suitable reels are two types: SD-structural drum and CD-corrugated drum. The choice of the reel depends on the customer's request, both reels are suitable for the same application, but some customers prefer SD-structural drum version due to the internal surface of the flange which is flat and does not compromise the quality of the wound material. Both types are designed to support large loading capacity, with reinforcements in the barrel and on the flange suitable for heavy duty processes.

GMP Slovakia technical staff also studied different solutions which can permit loads to these drums in box containers without space problems. Different options are available: painting, customising with tare, numbering, customer's logo, dynamically balancing up to Ø 1,600mm flange, statically balancing for bigger drums and hardened changeable bushings.

All dimensions are available according to customer's request. The plant is organised to manufacture reels of every size. GMP Slovakia also manufactures different equipment to handle the reels, in vertical or horizontal positions. Many other products are included in the range.

GMP Slovakia – Slovakia
Website: www.gmp-slovakia.com

▲ *Part of the reels range from GMP Slovakia*

wire 2012 celebrations for IWMA

THERE were many reasons for celebrations at the recent wire 2012 exhibition in Düsseldorf for the world-leading wire and cable association, the International Wire and Machinery Association.

Visitors flocked to the association's new-look booth and a large number of new memberships and over 70 enquiries were also recorded for the UK-based association.

In addition to signing up many new companies, current members – whether exhibiting or visiting – could take advantage of the services on offer, including a comprehensive office service, multi-lingual staff, Internet, phone, fax and photocopier, as well as a free bookable meeting room.

There was also further cause for celebration at the association's annual industry dinner held on the Tuesday evening. More then 260 guests enjoyed the dinner, preceded by the formalities of a number of presentations, made by association chairman Steve Rika and president Colin Dawson.

Dr Horst Scheid, from Siebe Engineering, Germany, collected the association's non-ferrous award; while the ferrous award was shared between R Lux, from Ilmenau University, Germany, and V Geinitz, also of Ilmenau University.

The IWMA also made a presentation to Hannelore Zander, from Messe Düsseldorf, for her tireless work over the years assisting the association and its members over many years.

▲ *The new-look booth which visitors called at during the exhibition*

Joachim Schaefer and Friedrich Kehrer, both of Messe Düsseldorf GmbH, wire 2012 organisers, joined Mr Rika and Mr Dawson in making the Travel Award presentations on Wednesday at the IWMA booth to:

Stephen Longville, of Cimteq Ltd; Ms Xing Xiao Zhang, of No.23 Research Institute, CETC; Benjamin Turner, of Wintwire; MS Abu Bakar, of Metalube; Don Teng, of Ugear Automatic Machinery; Erica Gateley, of Bridon International; Kamalakannan Elangovan, of Innovites BV; Lijuan Ma, of Anbao (Qinhuangdao) Wire & Mesh Co Ltd; William Thomas Binnie, of Kiveton Park Steel; Chuan Chuan Zheng, of Sinosteel; and Peng Chan, of Zhengzhou JinDi Metal.

International Wire and Machinery Association – UK
Website: www.iwma.org

▲ *IWMA president Colin Dawson, right, presenting Dr Horst Scheid, of Siebe Engineering, with the non-ferrous award at the gala dinner*

▲ *The new data centre from Datwyler*

Datwyler wires up new data centre

WITH a view to streamlining its operations, LVR-InfoKom, the system house for the Rhineland Regional Association LVR, has expanded its principal data centre in Cologne, Germany, and relocated it to a new building. The contract for the re-wiring was awarded to Datwyler who offered an economical overall solution and rapid completion.

In 2009 LVR-InfoKom decided to extend one of its two data centres and to relocate it to a new building, which, in addition to the server room, also comprises a number of function rooms. In the new data centre all the active components were to be interconnected by means of a future-proof, top-of-rack cabling system.

In the copper technology sector, therefore, tenders were invited for a class EA system with a 10 gigabit capability. In the fibre optic (FO) sector the LVR wanted OM3 multimode cable and, for the link to the outside, OS2 singlemode cables in buffered fibre assembly which were to be supplied complete with cable splitters and pre-assembled LCD connectors.

In addition to acceptance measurements and a function test on the cabling, a system guarantee covering 20 years plus a full set of documentation were required, which also had to include the link-up of the active components. The extended cabling project was to include the construction of the cable runs, firestop facilities between the rooms and the housing of the cable runs in the corridors.

The contract for this was awarded to Datwyler. "As far as we were concerned, the strength of the Datwyler tender lay not only in the highly economical solution which was put forward, in particular for the FO lines, but also in a plausible plan outlining just how the very tight installation times could be adhered to," said Michael Kemper, director of communication technology at LVR-InfoKom.

Datwyler's approach to implementing the order was to apply a turnkey strategy. Within just a few days the teams from Datwyler were able to lay the type 7702 copper cables, assemble them with connectors and finally measure and document the line segments – around 1,000 of them with a total length of 16 kilometres. The pre-assembled FO trunk cables (multiple cables) – a total of 210 lines, in most cases with 24 fibres each – arrived inclusive of the test reports in a number of part deliveries and were installed immediately in each case.

A further 1,500 copper and fibre optic patch cables, 400 patch panels and patch bays as well as around 200 optical distribution boards form part of the system.

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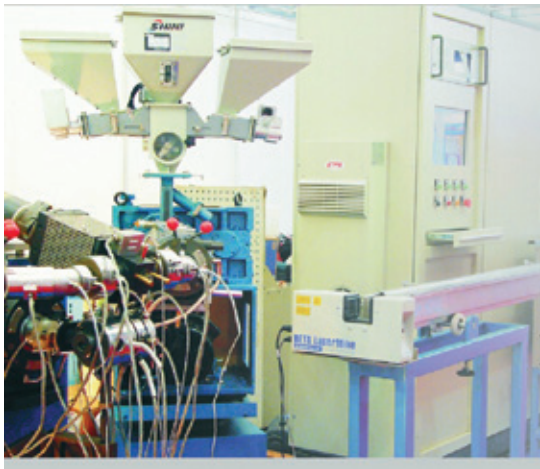

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Retirement of executive secretary

The International Wire and Machinery Association has announced the retirement of executive secretary, Phillip Knight.

Mr Knight, who had been in the position for ten years, intended to retire in the summer but because of health concerns retired on 29th February 2012.

IWMA Chairman Colin Dawson, on behalf of the executive committee and all member companies, wished Phillip a long and happy retirement. The appointment of a new executive secretary will be announced in due course.

Any enquiries should be directed as usual to the IWMA offices on +44 1926 834680 or via email at info@iwma.org

International Wire and Machinery Association – UK
Website: www.iwma.org

Transatlantic Cable

The Panama Canal expansion

Nearing completion, a project with potential to boost trade between Asia and the United States is raising belated concerns

In October 2006 the citizens of Panama, in a national referendum, approved by 76.8% of the vote a plan to expand the Panama Canal to allow for more transits and bigger ships. In September 2007 the Panama Canal Authority began to execute the project, expected to take eight years and cost $5.25 billion. The expansion – which Panamanian officials have said will make Panama the strongest economy in Central America – is on schedule for completion by 2014, the 100-year anniversary of the canal. Its aim is to double the capacity of the structure by adding a third lane connecting the Atlantic, via the Caribbean Sea, to the Pacific. Post-Panamax (super-size) container ships 1,200 feet in length will carry three times the cargo of 965-ft Panamax ships and have readier access to ports on the East Coast of the United States.

The American Society of Civil Engineers considers the Panama Canal to be one of the seven wonders of the modern world. While its expansion is of tremendous importance to the Republic of Panama and its people, it is even more significant to the international maritime industry, which stands to benefit directly through lower shipping costs. Global consumers will eventually benefit from the greater capacity and efficiency of the canal.

The US – for which the canal keeps the cost of imported goods down, helping to dampen inflation – will definitely gain from the expansion. Five ports carry 70% of US ship imports: Los Angeles/Long Beach (California); New York/New Jersey; Seattle/Tacoma (Washington); Savannah (Georgia); and Oakland (California). All of these, together with the port of Charleston, South Carolina, either already can receive post-Panamax ships, or will be able to by 2014. The expansion also has the potential to increase trade between Asia and the United States. Post-Panamax ships are currently able to unload only at West Coast ports, their cargo shipped by rail to markets in the eastern US. After the expansion these ships will be able to unload on the East Coast, lowering the cost of Asian goods in the American market.

The expansion programme

The Panama Canal Authority is constructing two new sets of locks – one each on the Pacific and Atlantic sides of the canal. Each lock will have three chambers; each chamber will have three "water reutilisation" basins.

The programme also entails the widening and deepening of existing navigational channels in Gatun Lake.

It is at this point that concerns about the negative environmental impact of the expansion arise which, because of the size and scope of the project, could have considerable impact. Writing in the *Christian Science Monitor* (27th March), Panama correspondent David Francis reported that the primary worry is the possible contamination of Gatun Lake, Panama's primary supply of fresh water, with salt water. Mr Francis explained: In passages through the canal, salt and fresh water become mixed as the ships are raised or lowered through the series of locks. For the expansion to succeed, more water will be used in the lock system, with much of this water to come from Gatun Lake. "Fresh and salt water will be required to run through the channel, and this has a direct impact on Gatun Lake," the *Monitor* was told by Charlie Andrews, a partner at the New York-based global intelligence and advisory firm Ergo. "There are concerns about the ability to control the amount of seawater that flows through the lake."

The largest of the post-Panamax mega-vessels have the ability to carry up to 13,000 cargo containers. When the ships come up, water has to be pumped in from the sea. "How do you get enough water to raise these massive ships?" queried Mr Andrews. "Both sides of the environmental fence are trying to determine how much impact this expansion will have."

- The Panama Canal Authority would appear to have made up its mind in the matter. According to its statement on water safety, "The water quality of Gatun Lake is typical of tropical freshwater lakes, and will maintain its freshwater condition with the existing three-level locks system. According to the studies and simulations performed [for the expansion feasibility study], the addition of the new set of locks will not affect the water quality of the lake."

  Perhaps. But the potential for environmental problems was cited as well by Eric Jones, editor of the English-language *Panama News*. This source also suggested that the public may not have been made aware of all the potential long-term impacts of the expansion project, and that its economic benefit might have been overstated.

  "We didn't really have any kind of discussion and so much of the discussion we did have was patently fraudulent," Mr Jones said, in reference to the debate that preceded the start of the project. "There are major concerns, but we're not going to know how it works out until it's done."

- Appropriately, the *Monitor* article by Mr Francis was titled "Panama Canal Expansion to Ease International Trade, With a Grain of Salt."

Image: www.bigstockphoto.com Photographer Zsolt Ercsel

Transatlantic cable

The 'historic opportunity' of a pact with Japan would open up Canada to the world's third-largest economy

When, in Tokyo on 25th March, Prime Minister Stephen Harper of Canada and Prime Minister Yoshihiko Noda of Japan announced that the two countries had entered negotiations for a free-trade agreement, the two leaders pledged that their partnership would bring a bonanza of economic opportunity. "The potential for increased trade between us that will create jobs and growth and long-term prosperity is really enormous," Mr Harper said. Mr Noda, while no less bullish about the outlook for economic cooperation, framed the Canadian-Japanese partnership in somewhat different terms. He said: "We reaffirmed the importance to tackle outstanding global issues, particularly the issues surrounding North Korea and others in the Asia-Pacific region."

To Murray Brewster of Canadian Press, the national news agency headquartered in Toronto, the distinction in emphasis suggested a need for the Canadian side to look sharp. He wrote: "Trade experts say Canada will have to up its game because the Japanese are tough, skilled negotiators – probably the most formidable the Harper government has faced" since it launched an ambitious series of bilateral negotiations. ("Canada, Japan Agree to Enter Negotiations for Free-Trade Deal," 25th March).

Mr Harper stressed the significance to the Canadian economy as a whole of the two-thirds increase in exports to Japan that could eventuate from a trade pact. If an accord is reached it would be Japan's first with a country from the Group of Eight major economies, moreover one that makes an attractive partner. Canada is in a strong fiscal position and has probably the world's soundest banking system, and Japan has expressed an interest in increasing its Canadian investments.

But the Japanese prime minister also made it plain at a joint media conference in Tokyo that he sees Japan's cooperation with Canada in a context of regional relations with the new regime in Pyongyang. Mr Noda said that the partners would pursue enhanced defence and security cooperation, including the establishment of a small supply base in Japan that the Canadian military could use in emergencies. Ron MacIntosh, a research associate at China Institute and former trade negotiator who served in Japan, South Korea, and Taiwan, told Mr Brewster that Canadians must remind themselves that free trade in Mr Noda's part of the world is about more than lowering tariffs and offsetting subsidies. The Harper government, Mr MacIntosh advised Canadian Press, could expect to endure a learning curve "in Asian realities."

Automotive

'Cars are, to put it simply, a great untapped opportunity for the telecommunications industry'

The speaker – Bill Ford – was not misquoted. In February, in Barcelona, Spain, the executive chairman of the car company founded by his great-grandfather Henry Ford addressed the

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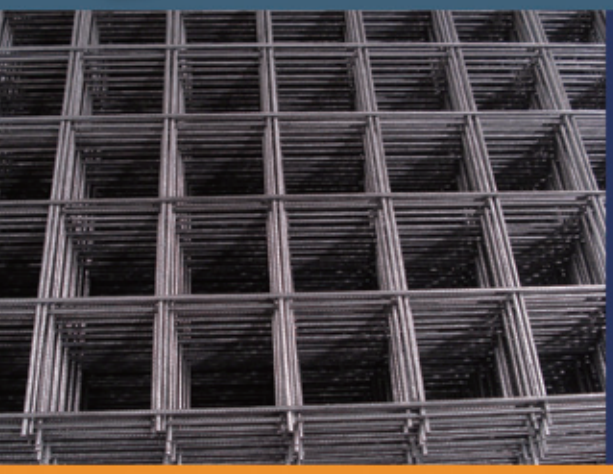

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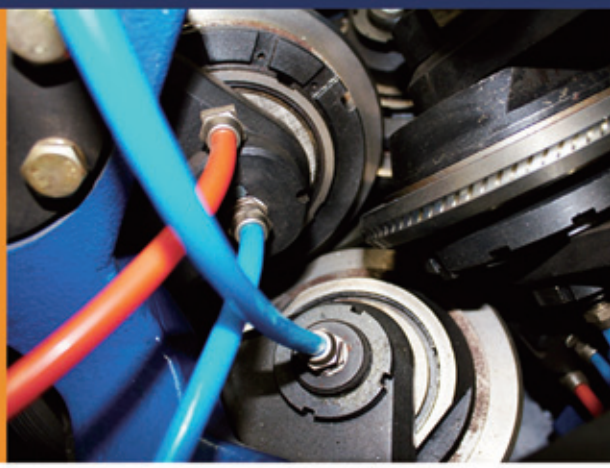

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Transatlantic cable

Mobile World Congress on a subject dear to his heart: the necessity for telecommunications providers and auto makers to work together to prevent gridlock from choking the world's cities and highways.

"When we do the math, and look at the global vehicle population, there is cause for real concern," Mr Ford told an audience of senior mobile professionals and mobile industry players from 200 countries. "There are about a billion cars on the road worldwide. With more people and greater prosperity, that number could grow up to four billion by mid-century."

As reported by *Detroit Free Press* business writer Brent Snavely, preventing that prospect – of a never-ending traffic jam that wastes time, energy, and resources – is seen by Mr Ford as the joint responsibility of auto makers, technology companies, and governments. ("Bill Ford: Cooperation Urged to Prevent Global Gridlock," 28th February). Wrote Mr Snavely: "Bill Ford sees a future when communications technology in vehicles will do more than simply sync an iPhone or play music from the Internet."

In Mr Ford's long-term view of the future, the urban transportation landscape will be radically different from what we know today. "We will have a true network of mobility solutions, all connected and operating together," he told the mobile industry conference. "Pedestrians, bicycles, cars, as well as commercial and public transportation, will be woven together into a single, connected network."

Automobiles, said the descendant of the inventor of the Ford Model-T, will probably look very different and will be able to navigate on their own. They should be connected to public databases that can recommend alternative options – trains, buses, carpools – when congestion is unavoidable.

In the meantime, Bill Ford has gotten behind an interim effort for relieving congestion on US roads and highways. In the week before Barcelona a venture capital firm that he helped start, Fontinalis Partners, said it had put $13.7 million into a Silicon Valley car-sharing company called Wheelz. Started up in the Autumn of 2011 at Stanford University, Wheelz links up California car owners willing to rent out their vehicles with drivers who do not own cars but occasionally need them.

A new 'paradigm of durability' is keeping older cars on American roads, longer

Another Ford, a writer on automotive topics for the *New York Times*, also has his views on the car of the future, but not in terms of telecom features or position in the transportation network. To Dexter Ford, the statistic that the average age of a car on the road in the United States stretched to a record 11.1 years in 2011 suggests a trend toward longer – much longer – life in service. This Mr Ford wrote: "Multiply that number of years by the annual miles driven – the EPA [Environmental Protection Agency] uses 15,000 for the cost calculation on fuel economy labels – and it becomes evident that one pearl of conventional wisdom has become outdated." That would be the wisdom of the 1960s and '70s, when odometers typically returned to all-zeros on reaching 99,999 miles. The idea of keeping a car for more than 100,000 miles was the automotive equivalent of driving on thin ice. You could try it, Mr Ford said. But you'd better be prepared to swim.

How far can a modern car be driven? Their budgets strained by a stubborn recession, many owners of cars began to push them farther; and, in the process, generated important information.

Transatlantic cable

The increasing age of vehicles on American roads indicates that the imagined limits of vehicular endurance may not be real limits at all. ("As Cars Are Kept Longer, 200,000 Is the New 100,000," 16th March).

The *Times*'s Mr Ford took note of the "common" phenomenon of online classified ads offering second hand Hondas, Toyotas and Volvos with 150,000 or 200,000 miles – or more – on them, not as parts donors but as vehicles with some useful life left. As he sees it, several factors have aligned to make pushing a car farther much more realistic.

- For one, customer satisfaction surveys show cars having fewer and fewer problems with each passing year. Much of this improvement is a result of intense global competition. A car maker simply cannot allow its products to leak oil, break down, or wear out prematurely.

- Another, less obvious, factor has been the government-mandated push for lower emissions. "The California Air Resources Board and the EPA have been very focused on making sure that catalytic converters perform within 96 per cent of their original capability at 100,000 miles," Jagadish Sorab, technical leader for engine design at Ford Motor, told the *Times*. "We needed to reduce the amount of oil being used by the engine to reduce the oil reaching the catalysts." This source also pointed out that, 15 years ago, piston rings, responsible for sealing combustion in the cylinder, would show perhaps 50 microns of wear over the useful life of a vehicle. Today, that total is under 10 microns.

- And materials are much improved. Ford Motor uses very durable, diamond-like carbon finishes. It has tested its newest breed of EcoBoost engines, in the F-150 pickup, for 250,000 miles. Mr Sorab declared, "When we tear the engines down, we cannot see any evidence of wear."

  Dexter Ford observed that the trend toward better, longer-lasting cars seems to have begun back in the '60s, when the first imports from Asia started to encroach on American and European car makers' sales figures. Now, he wrote: "Because of the improving overall quality of today's automobiles, many are discovering that it is entirely possible for a driver to wear out long before his or her automobile."

Metals

Federal aid for the auto industry entails an incidental but substantial benefit: restored funding for lightweight steel

On 22nd March, at Ohio State University, President Barack Obama announced $14.2 million in new US Department of Energy (DOE) grants to accelerate the development of high-strength, lightweight carbon fibre composites and advanced steels and alloys. The purpose is to help vehicle manufacturers improve the fuel economy of cars and trucks while maintaining and improving safety and performance, as well as reducing American dependence on foreign oil.

Ron Krupitzer, vice president of automotive applications for the steel advocacy group Steel Market Development Institute, said the announcement was encouraging for steel makers. Since the year 2000, the federal government had funded steel research by way of the US Automotive Materials Partnership – a group consisting of the car makers General Motors, Ford Motor, and Chrysler. But that funding ended last year.

"It is good news that advanced high strength steel is officially now part of a government programme to address fuel economy standards," Mr Krupitzer said. "There's a growing realisation within the car community and the government that there are benefits to gain from advanced high-strength steel."

Dustin Walsh, writing in *Crain's Detroit Business* (23rd March), presented statistics pertinent to the federal requirement that auto maker fleets achieve 54.5 miles per gallon (mpg) fuel efficiency by 2025. According to the American Iron and Steel Institute, advanced high-strength steels are currently 25 per cent lighter than traditional automotive steel. AISI said that, in 2010, steel made up 60 per cent of a car, with 17 per cent of that supplied by high-strength steel of varying grades. According to a Ducker Worldwide study, these grades are projected to grow by more than 300 per cent by 2020. Currently, no US steel maker produces high grades of advanced high-strength steel.

Mr Walsh recalled that funding for advanced high-strength steel was a source of contention in January, after the DOE in July 2011 conditionally approved a $730 million loan to Michigan-based Severstal Dearborn toward $1 billion in plant improvements for making high-grade steels. But members of Congress from other steel making states raised objections, and the DOE denied the loan. Pittsburgh-based US Steel, in a joint venture with Japan-based Kobe Steel Ltd, will begin operating a similar line to Severstal's proposed line at its Pro-Tec Coating Co plant in Leipsic, Ohio, by the end of 2012.

- Sergei Kuznetsov, CEO of Severstal Dearborn, said by email to *Crain's* that Mr Obama's announcement, in Ohio, was "yet another confirmation" of the importance of advanced high-strength steels as materials critical to energy-efficiency in automobiles. But he confessed to some perplexity, in light of the DOE's January decision against Severstal's loan application. He wrote: "Our Dearborn-based project is aimed at the production of exactly the advanced and ultra-high strength steels that the DOE is supporting."

Elsewhere in steel . . .

- Legislation pending in Ohio would allow local steel maker AK Steel Corp to convert waste gas released by its manufacturing processes into power for sale. As reported by the *Middletown Journal* (26th February), Senate Bill 289 would widen the legal definition of a renewable energy resource to permit the bracketing of waste gas with such sources of energy as wind and solar power. If the bill is passed, AK would earn credits for power generated at its plant that would be negotiable in the state's renewable energy market. Ohio companies that generate renewable energy can sell such credits to less environmentally-friendly companies or to organisations that simply wish to support renewable energy. According to Air Products and Chemicals Inc, aspirant owner-operator of the conversion facility, roughly 1 million MWh (megaWatt hours) of steam and electricity energy generated by the $310 million waste gas-powered plant would be used to power AK Middletown.

  The Ohio Environmental Council, a "green" group, backs the proposal but warned that passage of the bill could prompt a flood of credits into the state's renewable energy market. The concern is that this has potential to unbalance the market for producers of energy from other, more traditional, renewable sources.

  According to data from 2010, AK Steel's environmental capital investment in the three years 2007 through 2009 was over $5.2 million. Its environmental compliance costs for the period totalled almost $360 million.

Transatlantic cable

Fed up with thefts of metal for resale as scrap, Floridians mean to make things harder for the receiver

Lawmakers in Florida may soon give state and local authorities a new weapon with which to combat surging metal theft, notably of copper wire from dismantled air conditioners but also of metal from manhole covers, stop signs, and interstate guardrails – even park benches, railroad ties, and chain-link fence. As reported by the *Tampa Bay Times*, legislation awaiting Gov Rick Scott's signature would make it harder for thieves to sell stolen metals to recyclers. The bill calls for state-wide standards and a database of information on metal sales. It also increases penalties for metal theft and establishes a list of metals that may not be resold without proof of ownership. Recyclers would be required to obtain information about the seller as well as the metal, to be shared with law enforcement agencies.

"We think this is what we need to stop this crime," the *Times* was told by Keyna Cory, a coordinator for Floridians for Copper and Metal Crime Prevention, which supported the legislation. ("Florida Targets Metal Thieves," 26th March).

As reported by the *Times*'s Danny Valentine: For metal thieves in Florida, targets are everywhere. They've hit homes, businesses, churches, construction sites, utilities, telephone companies and storage lots. They've ripped out copper wiring, dismantled air conditioning units and illegally scrapped manhole covers, stop signs, interstate guardrails, park benches, railroad ties and chain-link fences. Now authorities hope they will get a new weapon in the battle against the surging thefts.

Two bills awaiting Gov Rick Scott's signature would make it harder for people to sell stolen metals to recyclers, stopping a crime that can mean huge losses for property owners, advocates say. "It's just hurt too many people – both in the pocketbook and with their loved ones," said Keyna Cory, a coordinator for Floridians for Copper and Metal Crime Prevention, which supported the legislation. "We think this is what we need to stop this crime. The primary bill (HB 885/SB 540) creates statewide standards and a database for recording information about metal sales. It also increases penalties for metal theft and establishes a list of metals that can't be resold without proof of ownership. "Why steal it if I can't sell it someplace?" asked Cory.

The legislation would require that metal recyclers take down sellers' information as well as information about the metal, such as a serial number. That information would be entered into databases shared by law enforcement. The bill (HB 885/SB 540) would stipulate a list of 20 items – among them funeral markers, storm grates, and beer kegs – that cannot be sold for scrap unless the seller can prove ownership or authority to sell it. Payment must be by cheque; no cash shall change hands.

The new law would make these requirements uniform across the state, superseding the existing patchwork of county-level regulations. And it has teeth. The charge for metal recyclers who fail to keep proper paperwork would go from a misdemeanour to a third-degree felony. That would be upped to a second-degree felony for third violations. Someone stealing metal from an electrical substation would face a first-degree felony charge.

Dorothy Fabian – USA Editor

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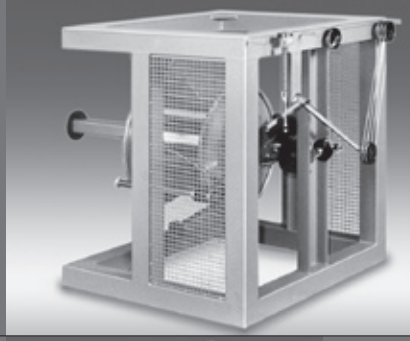

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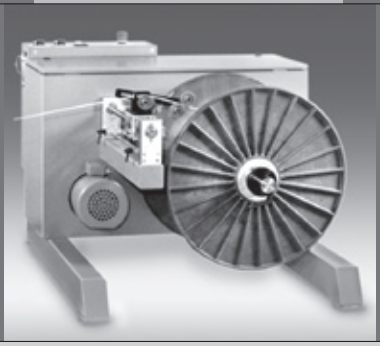

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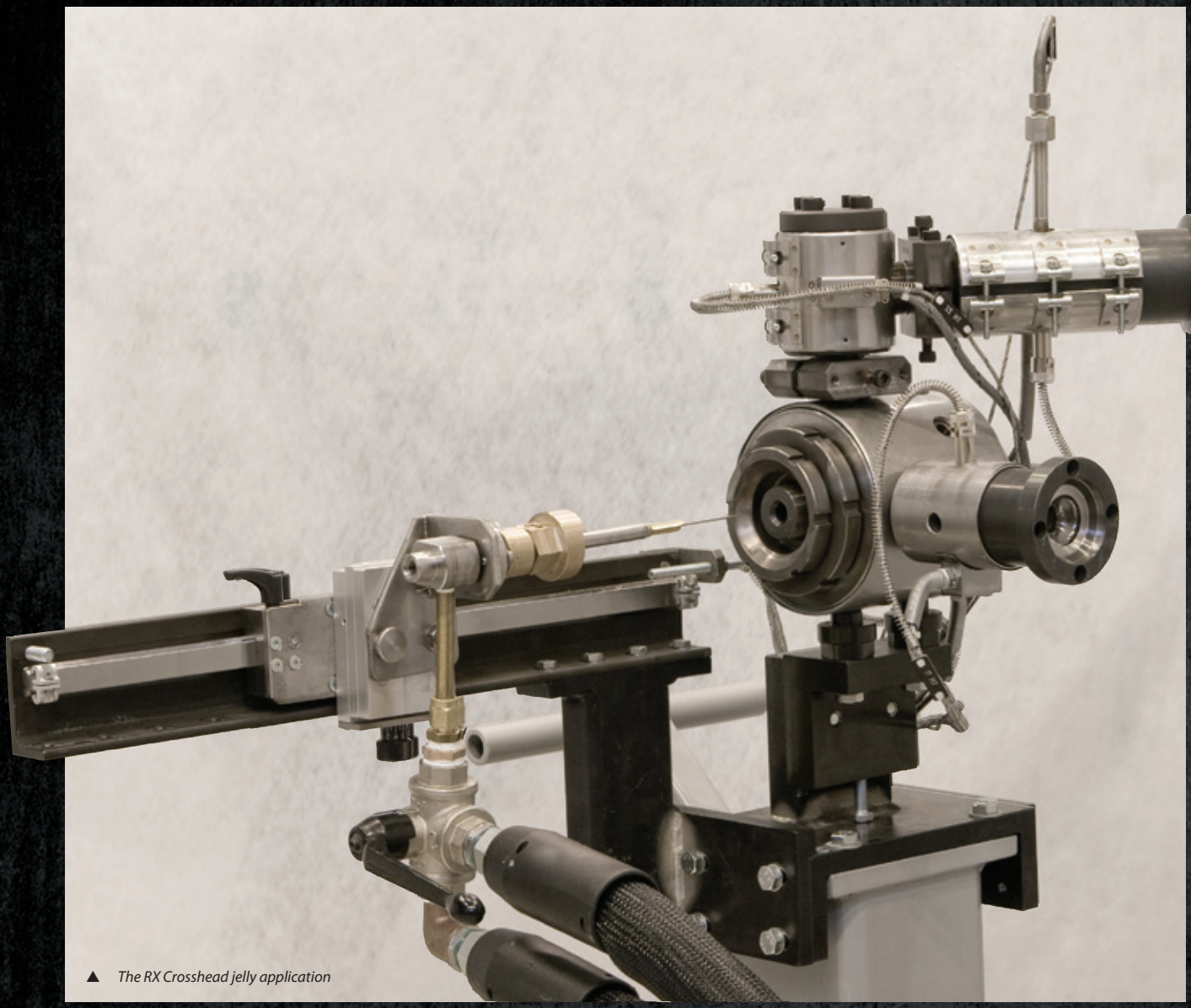

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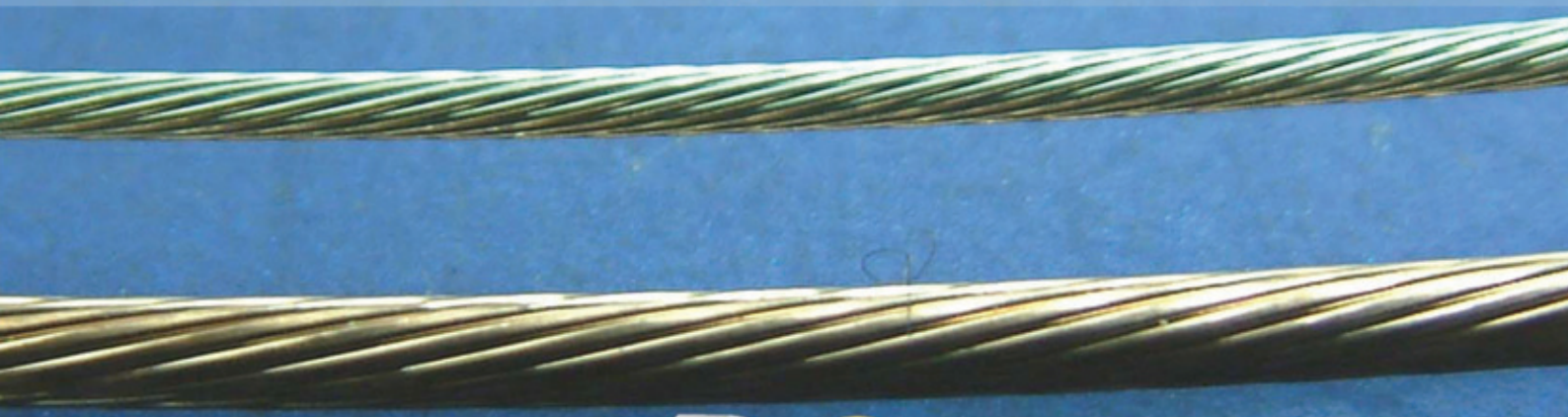

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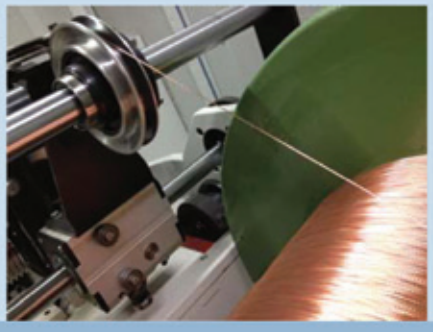

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es.taiwan@msa.hinet.net

BUNCHER SPECIALIST

▲ *The new cable from Hradil*

New sewer cable

HRADIL's new 10 core-sewer TV cable with central coax and a special fibre optic is specially designed for the Panoramo TV systems.

In addition to its clear price advantage in comparison to the original cable, it also provides some enhancements in the field of material properties and friction resistance.

The Hradil designers have sheeted an aramid yarn which not only provides the same tensile strength as the original fitted Kevlar meshwork but at the same time better resists humidity; the fibre optic has also been modified with a special two-layer-coating.

These properties enable an optimal absorption of lateral pressure within the cable.

Hradil cable for the IBAK Panorama systems is available from stock – either in the standard lengths or alternatively at any length and by request fitted with the corresponding plug.

Hradil Spezialkabel GmbH – Germany
Website: www.hradil.de

MG700 for all types of standard mesh fences

Schlatter has introduced the MG700 industrial mesh welding system for the competitive production of all types of standard mesh fences, including safety and security fences, dual-wire fences, privacy fences and mobile building site fences.

The MG700 fence wire welding systems from Schlatter are suitable for the competitive production of dimensionally-accurate meshes in small to large batch sizes.

The wires can be straightened and cut in the system or fed directly from the coil.

The Schlatter Group is a plant manufacturer, providing resistance welding systems for specific industrial solutions as well as weaving and finishing machines for paper machine clothing, wire cloth and mesh.

Schlatter Industries AG – Switzerland
Website: www.schlattergroup.com

Extending the Jacketmaster range

ZUMBACH Electronic has extended its well-proven Jacketmaster system for sector insulations and sector cable jackets with the new oscillating DVW 2 measurement device.

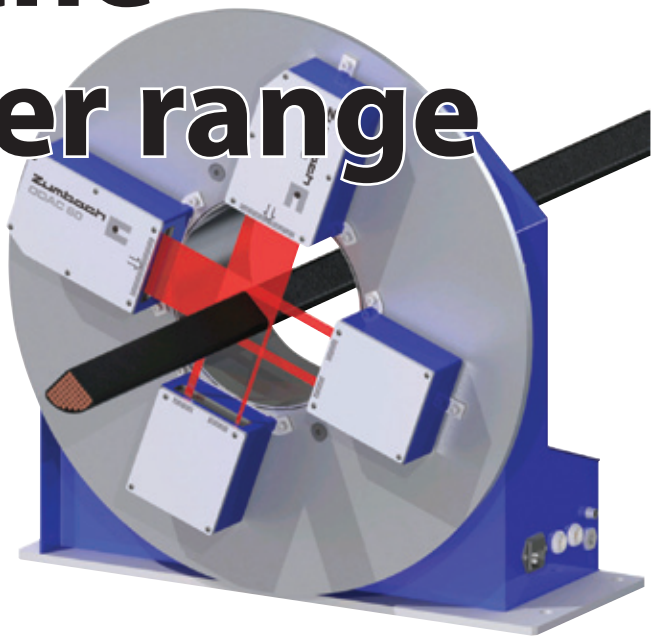
Straight and pre-spiralled sectors, solid and stranded, aluminium and copper can be measured and controlled.

Width, height and insulation thickness as well as diameter, ovality and jacket thickness can be measured and calculated at accuracies within a few 1/100mm.

Two highly precise DVW 2 measurement devices dynamically capture the relevant dimensions at high rates, before and after the extrusion.

With an optional third measuring head at the cold end of the line, the hot-cold shrinkage can automatically be compensated.

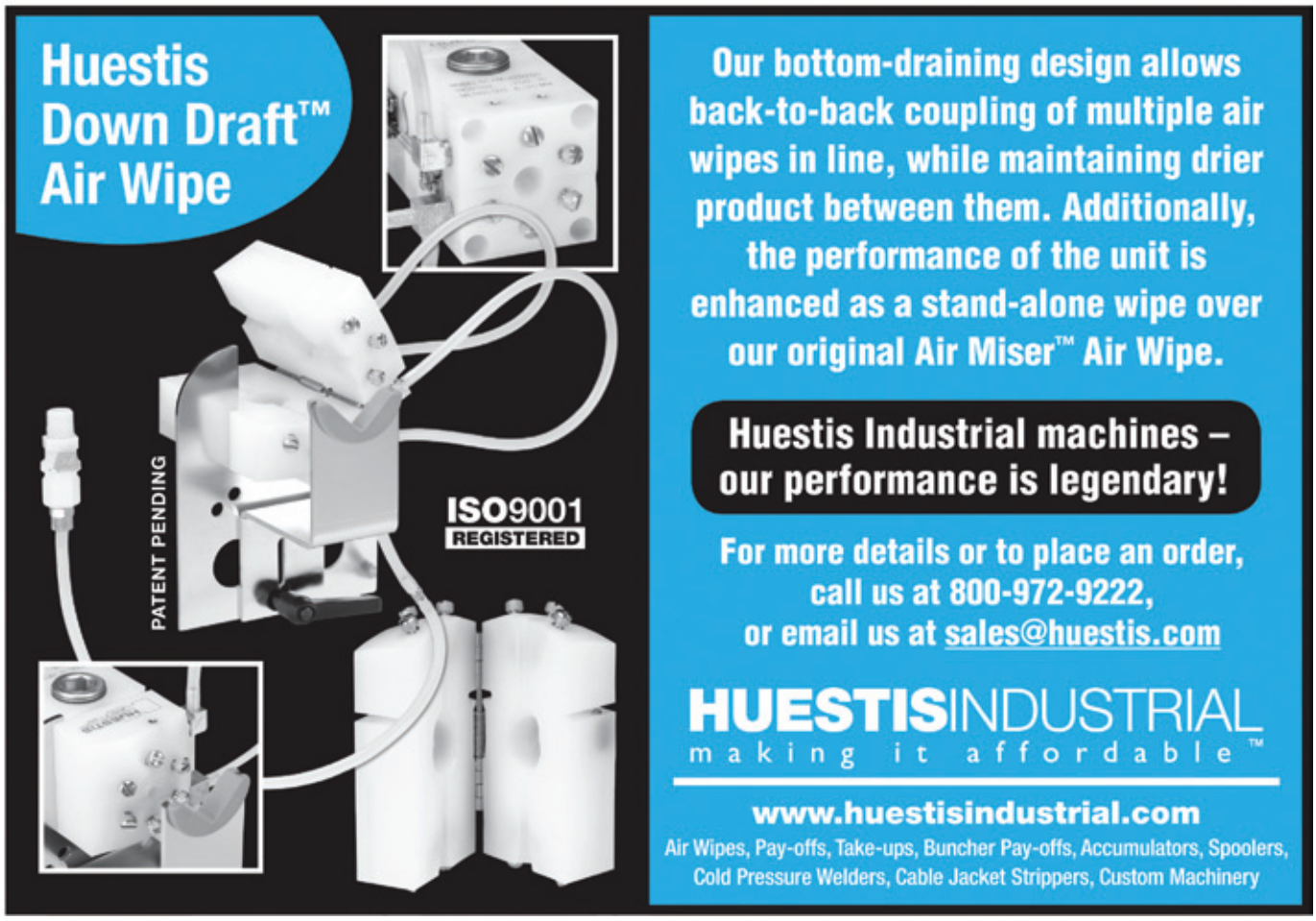
The Jacketmaster processor works with a sophisticated software. It displays the all-important data in numerical and graphical form, monitors tolerances and controls the process for optimised thickness and material consumption.



▲ *Oscillating DVW 2 measurement device*

It also calculates statistics and has all necessary outputs for interfacing with external networks.

Zumbach Electronic AG – Switzerland
Website: www.zumbach.com



Length 6000 – accurate measurement of produced cable lengths

WITH the help of the Length 6000, cable manufacturers can measure the cable length during production and ensure that only the accurate length is supplied or further processed.

The Length 6000 is a reliable non-contact online length measuring device for cables, tubes and pipes. The device tracks the micro structure of the product surface, detects the movement by image comparison and precisely measures the length of the product.

The technology of the Length 6000 is based on an optical measuring principle. The surface structure on the bottom surface of the passing product is defined by two neighbouring CCD-image sensors. The length is measured and speed is calculated from the correlation of both images.

The technology of the Length 6000 is equally reliable for round and sector shaped products and for products with reflective and rough surfaces. The system recognises whether the product is moving forward or backward and calculates the length precisely from zero line speed.

Sikora AG – Germany
Website: www.sikora.net

▲ *The Length 6000 measures precisely the length of produced cables*

Electrostatic powder coating machine

THE electrostatic powder coating machine model RSC of Hamburg, Germany-based Rolf Schlicht GmbH was designed for an even, finely dosable and absolutely dust free powdering of cables, wires, hoses and profiles with powders like talc, stearate, lac powder, swellable powder, etc.

By the electrostatic charging of the powder a strong adhesive and even layer on the surface is reached. The electrostatic also makes sure that no powder falls from the product outside of the dusting chamber. Depending on extrusion speed and product diameter, one to four powder guns of 100kV each are used.

In the machine there is a fluidised powder hopper out of which the powder is sucked by pneumatic venturi pumps and blown to the guns. For an optimal adjustment of the powder quantity you can adjust the power of the electrostatic charging from 0-100kV, the powder quantity and the speed of the dust cloud. Depending on the product the powder gun can be equipped with different powder nozzles.

In the machine there is a fully automatic and maintenance-free filter system that is cleaned off by a special process. Thanks to this filter system a strong and constant vacuum is generated in the machine, guaranteeing no escape of the powder.

If there is not enough space in the line to place the machine Schlicht can deliver a free-standing dusting chamber which is connected to the machine by hoses.

For an extremely fine powdering of slowly running products Schlicht offers a fine dosing device to make sure that only a minimal amount of powder is transported to the guns.

▲ *The model RSC from Rolf Schlicht*

Rolf Schlicht GmbH – Germany
Website: www.schlicht-gmbh.com

Heavy-duty rigid stranding cage from Queins

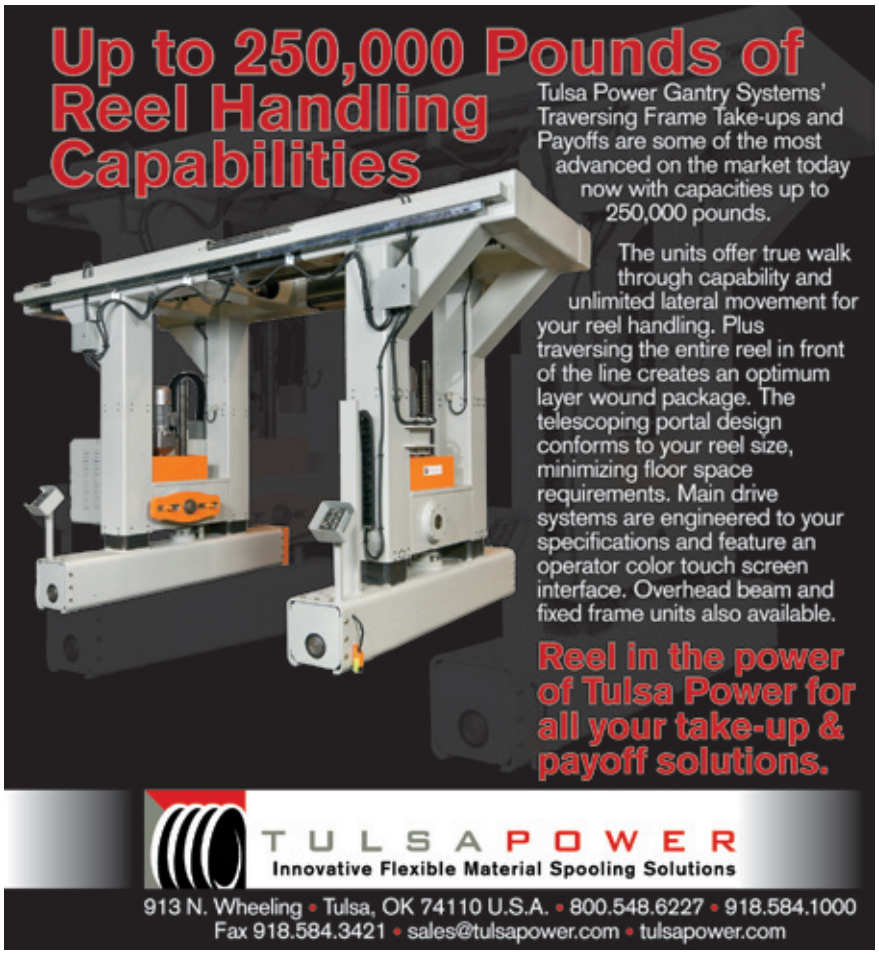
Queins Machines showed customers a newly manufactured heavy-duty rigid stranding cage for top or side loading, for round or pre-twisted sector conductors as well as trapezoidal wires, at wire 2012.

Also on display was a section of a high-speed skip strander for 1+6 bobbins 630mm, various cradles for planetary stranders, as well as a high speed steel taping head for two pads 600 mm ø.

Queins' main products are all kinds of high-speed stranding machines, machines for CTC conductors, pay-offs, take-ups, taping heads, disc and belt-type caterpillars.

The second-hand department also offers a full choice of machines and equipment.

Queins Machines GmbH – Germany
Website: www.queins.com



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▲ *The water processing unit from Haefely*

Water processing at its best

CABLE test termination systems are used for high voltage testing of power cables. Before high voltage (AC or Impulse) can be applied the power cable needs to be prepared and terminated in a special way in order to control the electrical field distribution along the ends.

The Haefely water-filled cable test terminations (CTT) and water processing unit (WPU) offer the perfect connection for these tasks. The new generation of CTTs are optimised for AC routine testing and completed by a modern, easy to use WPU.

The CTT range covers rated AC voltages from 100kV up to 800kV and are for diameters of 115, 130 or 165mm maximum across the outer semiconducting layer.

Advantages include: short tubes for easy handling and less cable waste, rugged design, hydraulic jacking system (manual or automatic), new service friendly design, pneumatic valves ensure partial discharge free operation and a modern user-friendly touch screen interface.

Haefely Test AG – Switzerland
Website: www.haefely.com

Stranding in high-tech mode

WITH Niehoff's high-speed rotating machines and numerous other production equipment application-specific lines can be configured to manufacture all types of data and special cables, including LAN cables in all categories – current, under development and future – with the utmost precision.

In order to remain competitive, cable manufacturers need quality production equipment that saves energy and reduces raw materials and consumables consumption. The data and special cable stranding technology developed by Maschinenfabrik Niehoff meets these requirements.

For the last 50 years, Niehoff has been building bunching and stranding machines. During this period, these machines have undergone continuous development resulting in the D series double twist bunching machines.

This new series buncher is known for several new features including a single-bow design and a non-contact machine data transfer which significantly reduces energy consumption, noise emission and maintenance compared to conventional two-bow constructions.

The successful concept of the D series bunchers is used as a basic platform for the DSI type double twist stranding machines.

The DSI equipment is used for the manufacture of all kinds of data cables and special cables like sensor cables, signal cables, bus cables, instrumentation cables and LAN cables of all categories with the required precision.

The double twist stranding machines DSI 631 and DSI 1001 are built for a maximum strand diameter of 8mm and 15mm, respectively. Energy efficient drives, wind tunnel optimised bow profile, single-bow design and the use of other energy-saving components result in considerable operational energy savings.

Compared to conventional stranding systems energy savings of 20% to 30% can be achieved under the same operating conditions.

The machines built in left and right-hand versions can be combined with additional ancillary equipment like tangential pay-offs, double twist back twist pay-offs, longitudinal tape pay-offs, pre-twisters and diverse spooling units to create stranding lines for specific applications. For advanced data cable applications a double twist back twist pay-off capable of generating back twist ratios from 0%-100%, or even higher if required, is available.

Optionally the double twist back twist pay-offs can be used to enable a triple twist stranding process. In this configuration the stranding speed and therefore the production capacity can be increased considerably and – as a consequence – production costs can be reduced further.

Depending on line configurations, up to three foils can be applied in-line on the cable under controlled film tension (multi-taping).

Because of the modular concept, these lines can be adapted to increasingly changing cable designs and specifications. The flexibility of the equipment lines allows for easy reconfiguration of a line for the manufacture of other kinds of cables in case a line is not fully utilised with the stranding of data and special cables.

Furthermore, the modular concept enables the realisation and modification of completely new manufacturing processes. And last but not least, the production of new products can be easily tested.

A DSI 631 stranding machine is capable of pairing insulated conductors into UTP and FTP cables Category 5e and 6 with a bow speed of 4,200-4,800tpm. In case of the triple twist process, line speeds up to 6,000tpm can be reached.

S/FTP cables Category 6 to 8e can be paired with a bow speed of 3,200 to 3,500tpm (with film). Further processing on a double twist stranding machine type DSI 1001 or a double twist bunching machine type D 1001 can be achieved with a bow speed of 2,500 to 3,000t/min (Cat. 5e and 6) or 2,000 to 2,500t/min (Cat. 6-7).

Maschinenfabrik Niehoff GmbH & Co KG – Germany
Website: www.niehoff.de

Advertorial on behalf of Decalub

Rod preparation: Dry vs wet. Anti-friction high melting lubricants eliminate wet pre-coating

THE rod Dry Cleaning, Coating and Drawing (DCCD) process revolutionises wire drawing by replacing conventional rod wet preparation including acid cleaning/ rinsing/wet pre-coating chemicals and drying by a new totally dry process that offers substantial cost savings and a unique combination of simplicity and effectiveness.

The DCCD process is used in the most demanding H/C and L/C drawing applications from mechanically descaled uncoated rod, including 0.90%C, drawn directly without wet pre-coating chemicals, including spring wire, PC strand wire, plating wire, CO_2 welding wire, etc. The process operates at 'zero' maintenance cost as there are no acids, no hot liquid tanks for rod pre-coating, no hot air blowers to dry wet rod, and it operates at virtually 'zero' energy consumption.

An added benefit is the automatic control of lubrication parameters, including lubricant pressure, temperature and viscosity, enabling the use of anti-friction standard high melting lubricants (200-240°C / 392-464°F for H/C wire) which are instantaneously converted from solid into a liquefied state

▲ *Rod dry coating by LVC/PDH system, in a 0.85%C application*

and deposited on mechanically descaled uncoated rod, generating exceptional thermal stability at the highest drawing speed, 18m/sec (3,600 ft/min) for spring wire, completely eliminating the need for phosphate and borax pre-coating chemicals and their wet substitutes.

In operation, all lubrication parameters 'communicate' together in a sensitive and automatic multi-way interaction to form a high-density full-film anti-wear lubricant coat, weight-adjustable, enabling frictionless drawing by physical separation of wire-die contact in all drafts, at extreme speed dictated mainly by rod pay-off and wire take up modes.

Decalub – France
Website: www.decalub.com

One step ahead in cable taping

WTM's range of concentric taping lines, with horizontal or vertical lay-out, is able to satisfy any request for the tape application in the production of special wires and cables, even providing in-line thermal treatment by heating and sintering ovens.

Thanks to the extreme accuracy of its technology, WTM proposes taping lines working with rotation speeds up to 3,000rpm, maintaining the precision of a few hundredths of a millimetre in the tape deposition.

The machines can be equipped with fully electronic taping heads with multiple motors, suitable to control the tape tension from 30 Newton down to 100 grams. A special electronic system allows direct control of the tape tension in each working condition, even with the most critical taping materials.

Spinning heads for yarns are also available with the same precision and capability. A vision system, with a feedback signal provided by a camera, can be installed in all cases where a continuous monitoring and adjustment of the tape position is required during the taping process.

WTM Srl – Italy
Website: www.wtmachinery.com

▲ *The new Nylon from Tratos*

Going green!

NYLON, from electric and fibre optic cable manufacturer Tratos, is an environmentally friendly alternative to lead-sheathed cables for onshore power, control and instrumentation applications in the oil and gas industry.

These challenging environments call for exceptional durability from all equipment, especially cabling that may be permanently open to the elements or used alongside heavy duty, industrial equipment. In response to the growing market demand for more environmentally friendly cables, Tratos has developed a new lead-free barrier in its Nylon cable.

Nylon comprises three co-extruded construction elements. The AluPE layer features an aluminium coated tape, applied longitudinally, that provides a watertight seal. The High Density Polyethylene (HDPE) sheath provides resistance to inorganic chemicals such as chlorine. The third element – the PA sheath – provides resistance to organic materials such as benzene.

Providing the same level of protection against aggressive petrochemicals as traditional lead-sheathed cables, Nylon also features improved ease of handling and installation.

Tratos – UK
Website: www.tratos.co.uk

Meeting the highest standards

Both Pourtier and Setic, members of the Gauder Group, provide high quality rotating machines (bunchers, stranders and cablers) with the highest standards in design and manufacturing.

Pourtier, based in Chelles, France, develops comprehensive solutions for the production of all types of high voltage and extra-high voltage power cables, from overhead to insulated, AC or DC type.

Its rigid stranding lines – stranding up to 127 wires, copper, aluminium and aluminium alloy – are specially designed to produce a new generation of overhead conductor made of trapezoidal wire (ACSS/TW, ACCC) and also suitable for round compacted cores for HV/DC cables, sector cores for Milliken cables, regular overhead conductor (ACSR, AAAC) as well as steel wire armouring and copper wire screening.

The concentric stranding solution – stranding of copper, aluminium and aluminium alloy – is perfectly adapted for 37 wires bare copper and aluminium compacted strand production at high speed. To complete the operation, drum twister lines are the universal rotating cabler/armourer for laying-up of copper or aluminium conductors. Planetary lines are available for steel wire armouring of fibre optic and large submarine power cable and umbilical cables.

Setic, of Roanne, France, offers complete bunching/stranding solutions for the power cable and automotive industry as well as producing high quality special/LAN cables with enhanced performances (in one step or two steps according to product mix).

The range includes high speed double twist bunchers for 7, 19, 37 wires (unilay construction) or multiwires bunches, large double twist stranders/cablers for 7, 19 wires strands and assembling of conductors, double/triple twist twinners/quadders, ideal for all pairing operations for special/LAN cable; group twinners for twinning and stranding of high-end LAN cable in one tandemised operation; and single twist cablers/stranders for cabling of quality insulated cables.

Gauder Group – France
Website: www.gaudergroup.com

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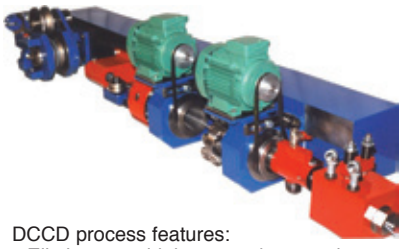

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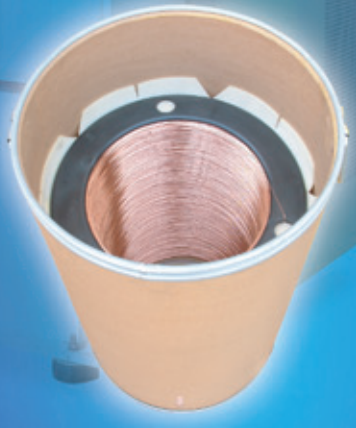

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Expect plenty to see, learn and do at the Wire Association International (WAI) Inc Wire Expo 2012, May 22nd to 23rd

The wire world moves its operations to Dallas, Texas, USA, this month as the Wire Association International hosts Wire Expo at the city's Omni Dallas Hotel.

The event – from May 22nd-23rd – is designed for operations personnel, features a plant operations focus through a diverse selection of case studies, conference sessions and production solutions.

Safety, eco strategies, patent law, machinery reliability, commodity outlooks, warehousing and distribution, fuel and truck options and logistics feature as highlights of the Expo.

For more details get this month's issue of wiredInUSA at www.wiredinusa.com and visit www.wirenet.org/events/wireexpo/index.htm

Image courtesy of Omni Hotels

Wire Expo 2012

Carris Reels Inc Booth 609

Carris Reels is a leader in the production of reels and spools – and a complete line of reels and accessories will be on display at booth 609.

Products include plywood reels, plastic spools, reel in the box inserts, nailed wood reels, in process wood/metal reels, hard-board reels and stamped metal spools.

Its manufacturing locations are strategically located in Rutland, VT, Enfield, CT, Galien, MI, Statesville, NC, Madera, CA, Fincastle, VA, Monterrey, Mexico and Montreal, Canada, and it also has an assembly warehouse location in Galien, MI and subcontractor assembly locations in Reading, PA, and Fort Worth, TX.

Carris is 100 per cent employee-owned and governed having served the wire and cable industry for over 60 years – and the collaborative spirit translates into the highest level of service and quality while proving creative, comprehensive packaging solutions for its customers.

One important area of focus is packaging efficiency – no one wants to pay anything more than necessary. To do this Carris reviews everything from carrying capacity to downstream handling – all required to best define the need.

▲ *A range of reels and accessories from Carris Reels*

Carris Reels Inc – USA
Website: www.carris.com

Cemanco Booth 710

For over twenty years, Cemanco has provided quality wear parts and machinery to the wire and cable industries.

To reach and maintain top quality of the finished product during wet drawing of non-ferrous materials the choice of the right drawing tools is essential.

Cemanco ceramics in zirconium or aluminium oxide are manufactured to the highest standards regarding raw materials, density and surface finish with each finished part subjected to two separate levels of end control.

Customers can choose from a large variety of drawings for standard machines like Niehoff, SAMP, Herborn, Henrich or Syncro.

▼ *Quality parts from Cemanco*

As a specialist for ceramic wear parts the company also offers a wide selection of standard ceramics like flanged eyelets, ceramic rods, tubes and bow guides in a variety of qualities and surface finishes.

Pulleys and sheaves are available in a choice of materials ranging from aluminium or steel coated with ceramic or tungsten carbide to solid ceramic or composites with metal or plastic flanges and solid ceramic inserts as well as plastic materials.

In addition to an extensive inventory Cemanco offers customers assistance with individual solutions. Custom parts can be provided with short turn around times even in smaller quantities.

The company offers KMK spooling traverses that are known for their cost efficiency, longevity and precision. These mechanical rolling ring drives are easy to maintain and have been the bench mark for take-up traverses for many years.

Recently KMK added a dual–laser guided, self-adjusting traverse system that automatically optimises winding results for a variety of spool types.

The system has been designed as a cost effective step towards automation and rationalisation of the spooling process providing consistently high quality winding results.

Roller guides for wire and cable and wire straighteners complete Cemanco's product programme.

Guides are available in many standard sizes from stock or as individual solutions, with standard hardened and chrome coated rollers or with special coatings like ceramic or tungsten carbide.

Straighteners come with standard quick opening levers and cover material diameters from 0.02" to 1.6" either with V-grooved rollers or custom radius grooved rollers.

Cemanco – USA
Website: www.cemanco.com

Commission Brokers Booth 215

Commission Brokers will be displaying photos and brochures of currently available used equipment as well as information relating to the company's appraisal, liquidation and consignment capabilities.

Martin Kenner, president, with over 43 years' service to the wire industry, ➤➤➤

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Rolling Forming Machines

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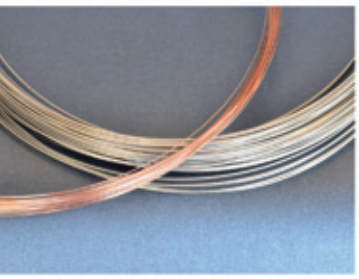
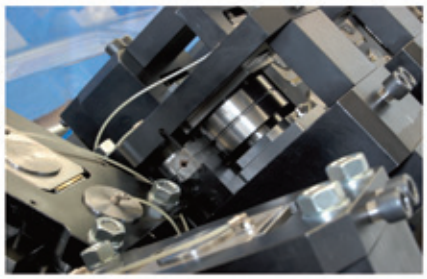

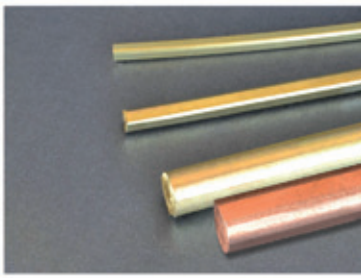

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specialises in non-ferrous wire and cable equipment, wire harness/assembly/processing equipment, and braiding machinery, from individual components to complete plants.

Commission Brokers Inc – USA
Website: www.comissionbrokers.com

Condat
Booth 616

Condat offers the most extensive product range for wire drawing, including pre-coatings, powder lubricants, neat oils and greases, soluble oils and pastes, weaving lubricants, cleaners and protective products.

▲ *Vicafil powder from Condat*

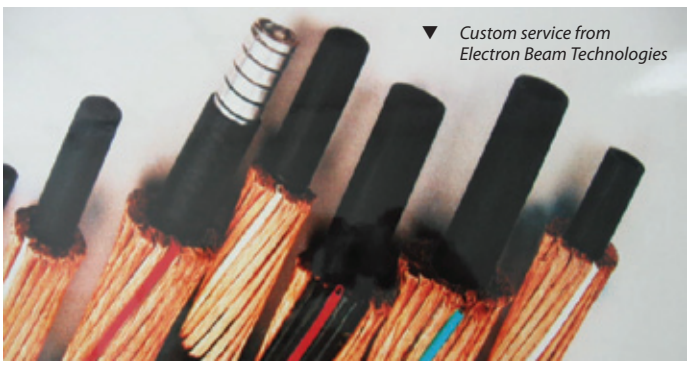
Condat continues to develop close partnerships with its customers to offer high performance products with environmental responsibility and compliance to the latest legislation.

Backed by a strong team of industry experts, Condat offers lubricant solutions for the most demanding applications and continues to develop new and innovative products and services for the wire industry.

Condat – France
Website: www.condatcorp.com

Electron Beam Technologies Inc
Booth 621

Electron Beam Technologies, Inc is a custom copper wire and cable service provider. Its capabilities in part or as a whole include rod knockdown, multi-wire drawing, wire bunching, stranding, rope stranding, insulating, multi-wire cable (bare or insulated), composite cable manufacturing and jacket cross linking.



▼ *Custom service from Electron Beam Technologies*

The electron beam cross-linking service is available for polymer enhancement in wire/cable, tubing and hose in both production and R&D environments.

Electron Beam Technologies Inc – USA
Website: www.electronbeam.com

Howar Equipment Inc Booth 418

Howar Equipment will showcase wire and cable manufacturing accessories manufactured by its European represented manufacturers.

Displayed products will include: steel reels, spools, carriers and reel handling equipment; mechanical wire descalers, rotating dies and scrap wire coilers; plasma wire surface and heat treatment; precision and high speed wire and cable taping lines; pay-offs, take-ups and tension control equipment; extrusion crossheads, automatic colour change systems, tooling, and automatic off-line cable cross-section measurement.

Special focus will be on the high precision extrusion cross-heads with particular attention on the new series of THHN capable crossheads. These crossheads are able to insulate two layers in one crosshead while processing two different temperature processed compounds such as nylon and PVC. Tooling changes still feature Unitek's four step system which does not require the entire head to be disassembled.

The complete line of accessories will be available in various media sources with help from experienced staff dedicated to the North American market.

Howar Equipment Inc – USA
Website: www.howarequipment.com

Ideal Welding Systems Booth 813

Ideal Welding Systems will be on hand to tell all customers about the company and its machinery and to help with production requirements. Ideal Welding Systems represents the Ideal and Clifford product line for automated machinery for resistance welding of wire, cable and sheet metal.

The equipment line up includes butt welders, automated mesh welding machines and CNC robotic welding machines. A team of experts will be on hand to help in the selection of the right equipment for your needs, along with sales material and videos.

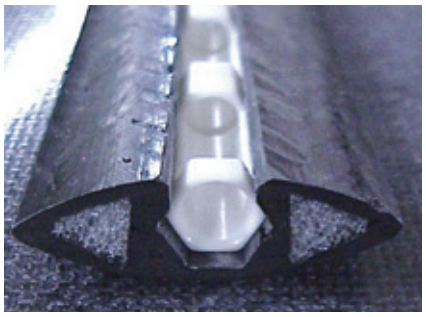
Also on display will be the latest Green line of machinery that reduces electrical consumption, helping you gain an edge on competitors.

Ideal Welding Systems – USA
Website: www.ideal-werk.com

Keir Manufacturing Booth 606

KEIR Manufacturing is an American-based manufacturer of high-purity 99.8% aluminia ceramic guides, the Frontiersman™ line of air wipes, and composite flyer bows serving the global wire and cable industry.

The company is dedicated to making products that enable manufacturing processes to run more efficiently and productively through the application of leading edge materials. Solutions are focused on continuous process improvement, energy savings and longer operating life.



▲ *The composite Backbone bow from KEIR*

KEIR's patented SureShot and SplitShot air wipes provide a far more effective drying method that does not depend on high-volume air consumption. The efficient design yields effective drying using a very low volume of compressed air and lasts much longer than other brands due to the rugged ceramic insert lining the wire path. This equates to over 25 per cent reduction in compressed air usage and an operating life of years versus months.

The company's triaxially braided composite Standard and BackBone™ flyer bow constructions have greater durability than layered/laminated designs allowing them to take more hits and endure higher stress yielding increased operating life and less machine downtime.

The more aerodynamic BackBone™ design functions at lower power consumption and higher TPM with improved wire quality and a further reduction in bow breakage. Up to 40 per cent less energy (AMPS) is used along with a decrease in wire scrapped.

KEIR Manufacturing Inc – USA
Website: www.keirmfg.com

LaserLinc
Booth 209

LaserLinc's accurate and adaptable non-contact laser and ultrasonic systems measure OD, ID, wall, eccentricity and concentricity for the wire, cable and fibre industries.

High-speed three-axis laser gauging for ovality and flaw detection, plus features such as FFT and SRL prediction, help reduce scrap, increase production efficiency, and improve quality.

The UltraGauge+™ ultrasonic wall thickness measurement system uses hardened stainless steel fixtures designed to withstand harsh wire and cable manufacturing environments, and UltraLock™ Auto Setup provides automatic configuration.

▼ *Accuracy on show from LaserLinc*

Gauges operate via PC-based Total Vu™ software. Total Vu gives you a complete audit trail of the process, including flaw reporting, SPC charts, and Excel-based user-designed reports. You also get real-time analysis, with run and trend charts, graphical cross-section display, and measurements in configurable, easy-to-read panels. Other features include in-process tolerance checking, feedback control and recipes.

Laser gauges measure diameters from 0.035mm (0.0014") to 120mm (4.7"), and feature compact models and the highest measurement rates available. With the UltraGauge+, you can measure wall thickness at up to eight positions with up to 2,000 measurements per second.

LaserLinc – USA
Website: www.laserlinc.com

Nextrom and Rosendahl
Booth 515

Nextrom & Rosendahl will be co-exhibiting at Booth 515.

Nextrom is a premium supplier of optical fibre glass preform manufacturing equipment, and produces fibre draw towers and associated machinery for the global fibre market using MCVD, OVD and VAD technologies. Besides providing optical fibre equipment, the company also supplies fibre optic cable production lines.

Rosendahl is a global supplier of high-tech wire and cable manufacturing solutions offering first class products and turnkey solutions in the fields of extrusion, corrugation, fibre optic cable and SZ Stranding.

Together Nextrom and Rosendahl offer first class products and turnkey solutions combining leading edge know-how and state-of-the-art technology in close cooperation with their customers and product suppliers.

Nextrom OY – Finland
Website: www.nextrom.com

Rosendahl Maschinen GmbH – Austria
Website: www.rosendahlaustria.com

Phifer Inc
Booth 704

With 60 years of wire drawing experience, Phifer is an international leader in the manufacture of aluminium round wire for a wide variety of applications. Phifer has some of the most diverse capabilities in the industry, producing custom aluminium round wire from numerous alloys in diameters 0.11mm-11.1mm.

Phifer aluminium wire 0.127mm, 0.16mm, 0.254mm and 0.32mm (0.005", 0.0063", 0.0100" and 0.0126") is used all over the world as coaxial cable braid shielding, shipboard cable armouring and hose braiding.

Other applications include weaving wire, industrial knitting, tea bag staples, semi conductor bonding, medical devices, stranded power cables, and lightning protection cables.

Newer products include copper clad aluminium, low carbon steel and bronze wire 0.127mm-0.50mm (0.005"-0.020"). Available packages for fine diameter wires include numerous returnable and disposable spools 0.34kg-14kg (0.75lb-30lb).

Phifer aluminium wire is also offered in larger diameters 0.81mm-11.1mm (0.032" to 0.4375") for use in wire forms, food packaging clips, automotive moulding reinforcement, vacuum metallising and more. Innovative machinery has expanded

and improved Phifer's selection, especially for manufacturers of rivets, staples and other fasteners.

Chemical processing and cleaning is offered for improved appearance and enhanced performance. Phifer also offers new precision-winding capabilities for aluminium thermal spray and metallising applications.

Packages include coils and stem carriers from 14kg-680kg (0.032" to 0.4375"), fibreboard drums, and over 40 spools and reels.

Phifer Inc – USA
Website: www.phifer.com

PWM
Booth 218

PWM's range of high-performance manual cold pressure welders will be exhibited at Wire Expo by Joe Snee Associates (Booth 218), PWM's newly appointed exclusive distributor for the US and Canada.

▲ *President Joe Snee*

PWM's manual range includes hand-held, bench and trolley-mounted cold welders, with capacities from 0.0039" to 0.141" (0.1mm to 3.6mm) copper and 0.197" (5mm) EC aluminium.

The M10, M25 and M30 hand-held models, for wire from 0.0039" to 0.071" (0.1mm to 1.8mm), are comfortable to hold and easy to operate, making them ideal for welding wire breaks in confined spaces. The larger BM10 and BM30 welders, for use on a workbench, are durable, low maintenance machines with capacities ranging from 0.0039" to 0.071" (0.1mm to 1.8mm) copper/aluminium.

The versatile M101, one of PWM's best-selling machines, can be used on a workbench or supplied with a trolley. The M101 has a capacity of 0.040" to 0.141" (1mm to 3.6mm) copper and 0.040" to 0.197" (1mm to 5mm) aluminium.

PWM cold welding equipment is made to high quality standards by skilled technicians in PWM's own UK workshops. Dies are individually hand-made in matched sets, in standard or custom sizes, to suit round or profile wire.

Pressure Welding Machines – UK
Website: www.coldpressurewelding.com

Radyne Corporation
Booth 103

Building on its success in delivering high speed spring wire lines, in-line bright annealing lines, and wire coating lines, Radyne developed a new induction heating coil technology for even heating of thin strip.

This revolutionary system delivers highly uniform heating across the strip for a wide variety of thicknesses and widths making it ideal for copper cladding of steel and aluminium core wire.

Radyne offers a range of standardised and integrated systems which are adaptable for many different applications and materials including annealing, hardening and/or tempering, relaxation, drying, preheating, brassing, coating, and heating prior to extrusion of wire and strip.

▲ *Bright annealer from Radyne*

Standard equipment includes the spectrum of heat treatment technologies including the industry standard High Speed Spring Wire Heat Treatment Lines, Hi-Bond® wire lines for pre-stressed concrete applications for the construction industry.

Complete turnkey systems from pay-off to take-up and for continuous induction heat treatment with typical power outputs from 3kW to 2,000kW at output frequencies from 250Hz to 800kHz and operating at line speeds in excess of 600 feet per minute are available. Savings over conventional methods of heat treat include utility costs, reduced scale losses and consistent results and improved quality. ➢➢➢


ELMECC-WTS

Wire Technology Systems

ACIMAF associated

VIA PRIMO STUCCHI, 78 20872 CORNATE D'ADDA (MB) ITALY
TEL/FAX: 039 6060227 E-MAIL: ELMECC-WTS@ELMECC-WTS.COM
WEB SITE: WWW.ELMECC-WTS.COM

ELMECC-WTS STARTS MANUFACTURING ELECTRONIC PLANETARY STRANDING LINES

Italy's ELMECC-WTS Wire Technology Systems announced the launch of a new line of electronic planetary stranders WTS-CP18X400. Combining highest flexibility and user friendliness with advanced technological solutions, this state-of-the-art stranding machine is designed to meet your versatility and space saving needs by guaranteeing the highest standards in product quality while keeping the price within reach. Suitable for joining max. 1+18 insulated and non-insulated wires, flexible and rigid, the line consists of three synchronized 1x6 detorsional cages with 1+6 / 1+12 / 1+6+12 / 1+18 operative modes, one pay-off 800 with automatic stretching control, one 800kg capstan as well as one 800 wap to wap self-aligning take-up. Thanks to its multi-motor technique with synchronization of profibus encoder, the line can reach a max. speed of 60 m/min with a stranding pitch of 25 up to 300mm.Provided with different types of sensors (stretching sensors for each wire, pintles safety laser sensor, wire breaking optical sensors), the line is controlled via two 15"touch panels for complete parameter setup and setting of the operative mode.

Radyne is part of the Inductotherm Group of companies serving the worldwide metals manufacturing industries.

Radyne Corporation – USA
Website: www.radyne.com

Sikora AG Booth 802

Sikora is showcasing the X-Ray 6000 for the measurement of the diameter, wall thickness, eccentricity and ovality at insulating and jacketing lines.

The X-Ray 6000 includes XLL-X-ray tubes (eXtra-Long-Life tubes) and provides a selectable measuring rate of 1 to 3 Hz or optional 10, 25 or 100Hz.

▲ *The Laser Series 6000 with an integrated LED display*

An additional highlight on the booth is the Centerview 8000, which measures eccentricity, diameter and ovality with the highest accuracy. The system is perfectly suitable for the production of coaxial cables, LAN cables as well as automotive and installation cables.

In addition Sikora will present the innovative diameter gauges of the Laser Series 6000 including a number of technological highlights, one being a measuring rate of 2.5 kHz.

The gauge heads are equipped with an integrated LED display with control panel option, which allows the operator to read the diameter value directly from the device.

Sikora will also show the Lump Series 2000 for reliable lump and neckdown detection during wire and cable production.

Sikora AG – Germany
Website: www.sikora.net

Teknikor Inc Booth 117

Teknikor is to open a new office in Kentucky to support the company's long-term growth strategy.

The integrated plant operations and relocation services provider is partnering with veteran industrial engineer and project manager Tim Tanner who joins the company as president of Midwest operations.

Industrial, governmental, institutional, commercial, retail and financial organisations rely on Teknikor for fully integrated facility and operations optimisation. Specific services include mechanical and electrical contracting, engineering and plant layout, automation and controls engineering and installation, fire safety maintenance and testing, plant relocations and precision alignment.

Teknikor's integrated team approach brings experienced engineers, project managers, fabricators and trades people together under one roof; making it easier and more efficient for plant managers to upgrade and streamline operations, manage productivity and reduce costs.

Mr Tanner comes to Teknikor from General Cable where, as senior project manager, he led the North American Project Leadership Group and was primarily responsible for capital expenditures for strategic projects and an annual budget that ranged from $6mn to $30mn.

With 30 years of industrial plant and project management under his belt, he has designed and managed innumerable plant consolidations, relocations, production expansions and equipment upgrades.

His professional credentials include a Lean Sigma BlackBelt — an industry recognised project engineering and management approach that combines lean manufacturing principles with the Six Sigma toolset to achieve long-term efficiencies and cost savings.

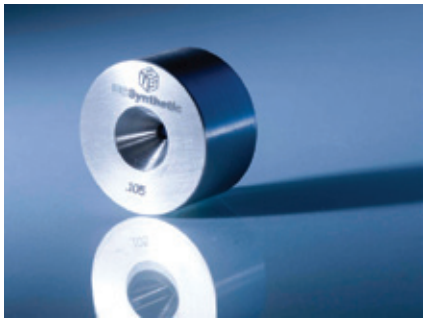
Although the location of the new office is still undetermined, Mr Tanner has already begun to assume responsibilities at his new post.

Teknikor Inc – USA
Website: www.teknikor.com

US Synthetic Wire Die Booth 419

US Synthetic Wire Die's objective is to help customers become more competitive by providing high-performance poly-crystalline diamond (PCD) dies.

Dies sized 0.004-0.385" diameter are available that use standard PCD blank sizes (D6 through D30).



▲ *Helping customers to remain more competitive*

US Synthetic is a leading producer of PCD for oil and gas drilling inserts and 2011 winner of the Shingo Award for operational excellence.

US Synthetic Wire Die – USA
Website: www.usswiredie.com

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Focus on Italy

A European industrial giant

There's far more to this Mediterranean jewel than food, wine and romance . . .

We wanted to know a little about Italy, specifically the wire and cable industry. Who better to ask than Ferruccio Bellina, right, president of ACIMAF – the Italian Wire Machinery Manufacturers Association?

Read his honest and open thoughts here and take your time to catch up with Italian companies featured in this section.

European news has been dominated over the last few years by economic gloom, although there is an optimistic feeling among companies this year. What has been the main impact on the wire and cable industry throughout Italy?

As of yet, the current economic situation shows no real signs of recovery and many analysts believe 2012 will be the worst period for industry. As for Italy, the latest data shows we are now technically in a recession. This scenario clearly makes it difficult to be optimistic in the short-term and the general economic situation obviously affects the wire and cable industry.

bigstockphoto.com – 'Vatican Steps' by Erez Shor

Have the political changes in Italy this year impacted on the industry in a more positive or negative way?

Traditionally, political changes in Italy have no major effects on industry.

Strong control of costs and reduction in state expenditures were and are necessary and we hope that the government continues in this direction, keeping in mind that competitiveness in the industrial sector is vital for our exports.

In your opinion, what is the most important thing to bring about commercial success for Italian wire and cable companies at the moment?

The competitiveness of our companies relies on their capacity to offer innovative solutions that allow cost reductions and improvement in product quality.

Special attention must also be currently paid to energy savings and the impact of these on humans and the environment. Pre and post sales customer support is also a determinant factor for success.

Do you think Italian companies should work closer in cooperation with each other to achieve success?

Over the last few years, the association has helped encourage potential contacts among our companies and develop new forms of collaboration, beyond simply the commercial.

In many situations, cooperation may be a decisive factor in offering winning proposals to customers, and, in any case, is an incentive for each individual company to develop and broaden its perspectives.

What sort of timescale do you foresee for recovery, or do you even see a recovery to the level of pre-recession stability?

Forecasts are extremely difficult to make, especially in a phase of great economic turbulence such as the one we are now experiencing.

In my view, substantial market recovery will be difficult unless governments implement decisive economic stimulus policies, especially here in Europe.


bigstockphoto.com – 'Gondola Parking' by ViniciusTupinamba

From a management point of view, what do you see as the most important aspect of maintaining a successful business and for getting it to prosper?

Many aspects should be taken into consideration and so these are difficult to summarise in just a few lines, given that maintaining constant profitability and development for a company is today becoming an ever more difficult and complex task.

Therefore, I do not think there is any one, single factor for achieving success. Success comes from the positive combination of various companies' capabilities, teamwork and the entrepreneurial will to succeed.

How important to the success of the industry are the exhibitions held around the world. Do you think there is a need for an increase or decrease in the number of these, and do you think they should be staged more often or less frequently?

The wire Düsseldorf trade fair is considered by all operators as the most important in our sector and has always been a positive, driving event for trade and business.

For this reason, the leading role of wire Düsseldorf must be maintained and undisturbed by events in other sectors that, besides being of little interest for operators, reduce the number of people present at the most important event where our associates invest significant resources.

Therefore, we feel the number of trade fairs should be limited as much as possible to help support wire Düsseldorf as the principal event in our sector, in the interest of exhibitors and visitors alike.

You are obviously very proud of the achievements of ACIMAF since its inception in 1987.

How do you see the association itself going forward and being of increasing assistance to its members?

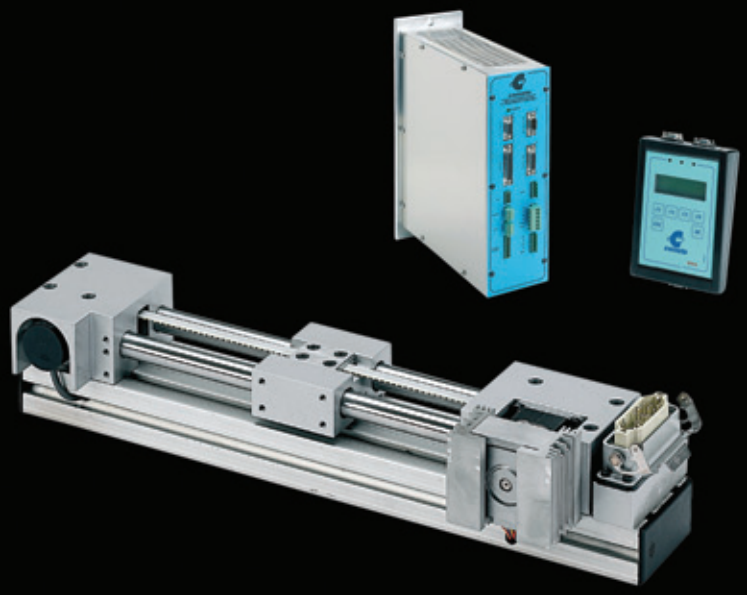
We feel ACIMAF has performed an important role for the development of our companies, providing them with valid support for their commercial and technical growth.

ACIMAF intends to continue this by developing new initiatives and encouraging further collaboration among companies.

Significant relationships developed over time with major international wire and cable associations have encouraged the global exchange of information and knowledge by organising seminars and distributing special technical and scientific literature.

In addition, ACIMAF has also been recognised by the Ministry of Development, which contributes through ICE to companies in promoting their export activities.

bigstockphoto.com – 'Trevi Fountain' by Gabriel Scott



SEMI-ELECTRONIC TRAVERSE UNIT

www.cometo.eu

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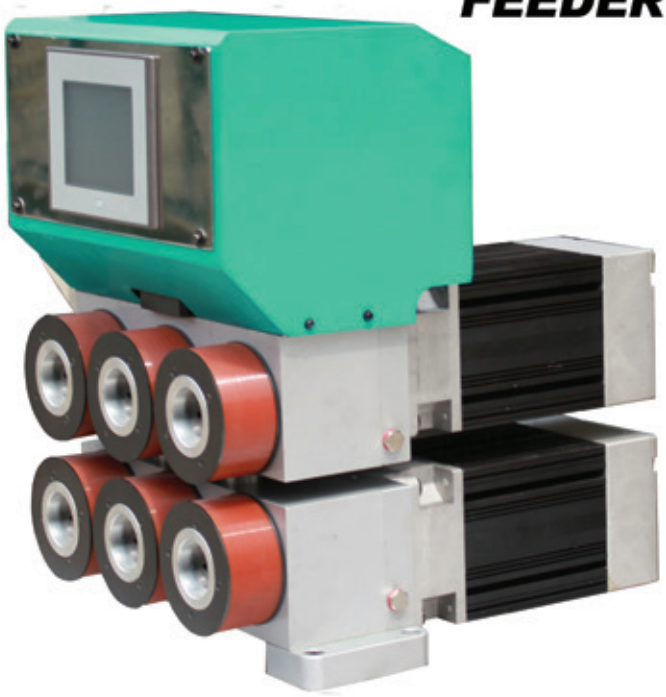
EFM3116 ELECTRONIC FEEDER



-Special roller sufrace finish without groove to feed wires from 1,5 up to 12mm diameter without the need to change the roller

-Can feed up to 5 wires simultaneously

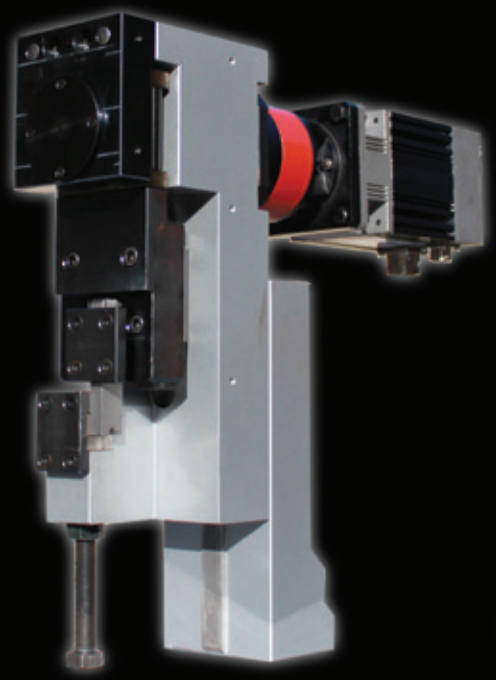
-Electronic drives

-Option to add cutter unit after feeding

-Touch-screen Operator interface keypad and display

NEW ECM05 ELECTRONIC CUTTER

Suitable for any round and shaped profile up to 5mm diameter or 20mm ² profile area.
Electronically driven and no need of pneumatic or hydraulic energy source.
Standard blade and matrix



COMETO di TOCCHETTI ENRICO & C. s.n.c. VIA CABELLA LATTUADA ,41 -23841- ANNONE DI B.ZA - LC TPH +39-(0)341-263090 FAX +39-(0)341-260927

Rolling technology for cold forming

DEM Costruzioni Speciali is strongly orientated towards innovation and the development of special applications for the ferrous and non-ferrous industry.

The company has a long record of projects with outstanding demands in terms of technical performance and precise order execution, some of which are detailed below.

In 2010 DEM designed and started up an automatic compact coiler with extra capacity up to 5-ton coils.

The challenge consisted in having a perfect layer oscillated wound coil up to 1,600mm OD and large size with 5-ton capacity.

Also in 2010, the company supplied one of the major Eastern European metallurgical groups of companies with worldwide operations.

The project included delivery of a complete state-of-the-art profile wire rolling line to produce shapes with tight dimensional tolerances at high speed, yet with very short, industrial start-up.

In 2009 DEM supplied a leading European company in the stainless steel and alloyed steel profile sector.

The challenge consisted of designing and supplying a complete state-of-the-art profile wire rolling line to produce shapes in stainless steel with tight tolerances, at a high speed of 8m/sec.

A year earlier, DEM supplied a European company in the stainless steel and alloyed steel wire sector. Conversion of a drawing line from die to micro-rolling concept resulted in higher speed, less maintenance and cut of intermediate treatments, and therefore increased uptime.

The challenge consisted in processing wires in stainless steel materials and special alloys using rolling technology, and making rolls fit to withstand the heavy load generated by such 'hard materials'.

DEM pools resources and know-how with its parent companies, EVG, Austria and GCR, Italy, and with customers through long-term cooperation.

▲ *Drawing line converted from die to micro-rolling concept*

The company is a comprehensive provider of rolling technology for cold forming of metals, including the design and supply of complete profile wire rolling lines for all metals; flat wire rolling lines for all metals; cold rolling lines for processing steel wire rod into reinforcing wire for the construction industry and cassettes; microcassettes and core equipment for wire fabrication; and equipment for welding wire fabrication.

DEM Costruzioni Speciali Srl – Italy
Website: www.demgroup.com

Wire drawing lubrication and processes

IN 25 years of activity in the wire industry, Pan Chemicals has dedicated its efforts and commitment to understanding wire drawing lubrication, wire drawing processes and specific customer problems and requirements. The company develops clean products and processes, and ecological lubricants, and promotes new, environmentally safe technologies in wire production.

The Pan Chemicals production programme includes different grades of calcium, sodium and combined dry lubricants (Panlube S series), and a full range of wet lubricants for low and high carbon, welding wire, stainless steel and non-ferrous wire (Panlube L series). The company also offers full technical support on wire production process and development of customised products.

The company has recently focused its activity on lubricant carriers for drawing of carbon steel wire, stainless steel wire and cold forming operation (Pancover series).

Particular attention is dedicated to the development of ecological products according to international regulations (borax-free coatings and lubricants).

The engineering department is proposing different solutions of descaling machines, coating devices, rotating die holders and die reconditioning equipment.

Pan Chemicals has recently introduced products dedicated to hot dip galvanising: Panflux series fluxing products are developed to improve the efficiency of the galvanising process by means of a more uniform control of the reaction at the interface of the two metals, reducing operating costs and improving the quality of the zinc coating.

Wiping pads are manufactured to custom requirements, and various models and sizes are available. Additivated charcoals are used as wiping media for high carbon and mesh galvanising, and are available in many series and compositions for different applications.

Pan Chemicals SpA – Italy
Website: www.panchemical.com

Cable winding and unwinding

Meccanica Nicoletti was founded in 1976, on the basis of innovative ideas in the field of single-core cables used for civil installations.

The company's work in cable winding and unwinding has helped to change the production methods of potential customers. The first machines were simple manual constructions, but now the company proposes machines that work with very small coils and large cable reels (up to 10 tons), and can meet nearly all requirements in the field of cable winding/unwinding.

Meccanica Nicoletti has focused on increasing the level of automation in its products, especially in building the Automat 300 fully automated winding, unwinding and binding line.

While the company initially operated only in its national market, it has now grown to cover international markets too, mainly in EU countries. Its network of agencies and resale points have enabled it to export to almost all countries, and exports now account for around 50% of production.

Meccanica Nicoletti Srl – Italy
Website: www.meccanicanicoletti.it

▲ *Reels from Boffi*

Wooden reels

BOFFI SpA operates production lines completely controlled by electronic apparatus, for the production of wooden reels with diameters between 400 and 4,000mm.

The company is able to meet market needs in quality and quantity, with a product guaranteed according to ISO 9001:2008; PEFC standard (Programme for the Endorsement of Forest Certification); and international standard FAO ISPM 15.

Boffi SpA owns three manufacturing facilities in Italy, in Cinisello Balsamo (Milan), Latina (Rome), and Pineto (Teramo), and one in Lyon, France, as well as several assembly centres near major customers. In addition to Italy and France, the company serves clients in major European countries and North Africa.

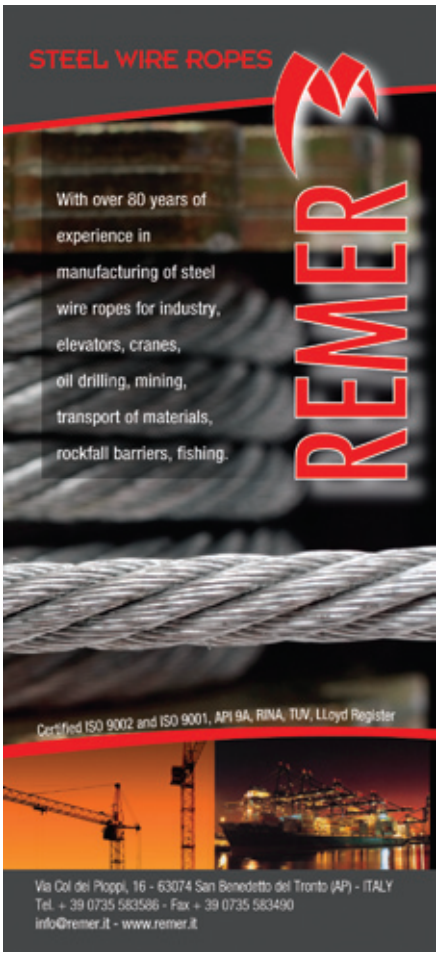
Despite the global financial crisis, in 2011 sales increased by 22 per cent compared to 2010, and 43 per cent compared to 2009.

The company's product range includes reels made of spruce for wires, electric cables, fibre optic, and steel cables, plates, welding wire, tape, piping and ropes. The reels are treated according to FAO ISPM 15 international standard, in autoclaves with anti-rotting, anti-termite salts. Reels can also be made from plywood, PVC, and cardboard, or from timber with flanges with an iron protective hoop.

Products can be supplied unassembled in kit form, or with an assembly service on the client's premises. The range includes recyclable, reusable, and one-way economy products.

The company also produces multi-layer and drum in steel for medium speeds (500 rpm) for internal use, and a range of components in iron (dished washers, bushes with plate, tie rods, bolts and nails).

Boffi SpA – Italy
Website: www.boffireels.com



Drawing and bunching solutions

▲ *Drawing technology from SAMP*

FOUNDED in 1936, SAMP SpA is part of the Maccaferri Industrial Group and one of the market leaders in the production of wire and cable manufacturing equipment and machinery. The company's product range includes state-of-the-art solutions for drawing copper, aluminium and relative alloys; a complete range of double-twist bunchers to strand copper wires and lay up insulated conductors; and a whole series of products to cover any cable manufacturing requirement.

SAMP wire and cable manufacturing machines and lines provide high productivity, flexibility, quality of the final product and savings in terms of energy consumption and raw materials. The company can personalise systems to meet specific requirements, combined with line management and control systems that can be integrated to any industrial computer or commercial control panel to interface all elements.

The company is based in Bentivoglio, Bologna, and operates all over the world through various production facilities and a widespread sales network, which includes subsidiaries located in the USA, China, Russia and India.

At wire Düsseldorf, SAMP presented its new multi-wire Drawing Machine Platform, designed for copper and aluminium wires, which builds on many years of research and in-depth testing.

In particular, the DM Platform aims at reducing production costs by increasing the energy efficiency and power factor of the manufacturing line; increasing the line productivity by diminishing set-up times, reducing and simplifying maintenance operations, ensuring an easy accessibility of the machine spare parts; and maximising the process efficiency thanks to a significant reduction of the acceleration and deceleration ramps.

The DM Platform consists of four product segments, designed to meet requirements depending on their final application (building wire, white/brown goods, automotive, etc): DM 80 EL (Entry Level) – up to eight wires per row and 22 drafts, maximum inlet wire 3.6mm; DM 80 – up to ten wires per row and 37 drafts, maximum inlet wire 2.05mm; DM 105-80 – up to 16 wires per row and 29 drafts, maximum inlet wire 2.6mm; and DM 105 – up to 16 wires per row and 25 drafts, maximum inlet wire 3.2mm.

The DM Platform features a new gear train, designed and engineered by the Sampingranaggi division, which ensures maximum, vibration-free performance and a significant reduction of the noise level, so that no soundproof cabin is needed.

Particular attention has been given to ergonomics and man-machine interfaces by a clear and rational distribution of services and accessories.

SAMP states that after in-depth testing in numerous customers' premises in real working conditions, the DM machines have obtained results showing a better wire quality, an average energy consumption reduced by over 30% and a power factor higher than 0.95.

SAMP SpA – Italy
Website: www.sampspa.com

Automatic winding machines on show

At wire 2012, OMR Srl displayed a new line of automatic winding machines for winding wires onto bobbins prior to the braiding process. The machines are equipped with touch-screen control with colour display, electronic thread-guide and change system with manipulator with direct taking of the wound bobbins, in order to ensure precision and reliability. The range also includes motorised unwinding devices.

OMR Srl – Italy
Website: www.omr-srl.com

Thickness measurement

THE Falcon Topscan AWM system allows fully automatic thickness measurement on insulating covers and non-metallic sheathings of electric cables.

The system, developed by Falcon Instruments, is a natural evolution of the profile projector or of the measuring microscope, and was designed to provide measurement objectivity and repeatability of results, along with time and manpower savings. It conforms to CEI 20-34/1-1 and the most important international standards.

At the push of a button, the system measures the thickness of inseparable insulating covers and sheathings, giving single thickness measurements. The system is also able to work with varying height cable samples and with a single parallel plane. This is possible due to a particular disposition of the camera, which allows it to acquire the face of the sheathing that is directly on the bearing surface. The instrument features a double interface level: the first level is for the line operator, and the second for a supervisor or for those who are in charge of quality laboratories.

All of the systems in the product line have been developed by the criterion of the Falcon MMI interfacing with the user, based on the concept of 'press a button and measure'.

The instruments have measurement repeatability of 1/4,000 of the field of view, and measurement reliability of 1/2,000. For example, the repeatability of the instrument with a 20mm field of view is equivalent to ±0.005mm, with instrument reliability equivalent to ±0.01mm.

Emmerre Srl – Italy
Website: www.emmerresrl.com

Get in real time control

Eldes produces and installs real time control systems applied to metal cold forming, both cold headers and thread rolling machines. They are based on the supervision of the force developed in the production process, by means of piezoelectric sensors applied to the sensitive points of the structure. This type of control is a necessary condition for starting a production cycle even when operators are absent.

The first control systems entirely based on Italian technology were developed by Eldes in 1982. Preserving continuity and always looking for innovation, Eldes followed, and often anticipated, progress in cold forming technology, developing the new generation of process monitoring to which Helios 2K and Titanus 2F belong.

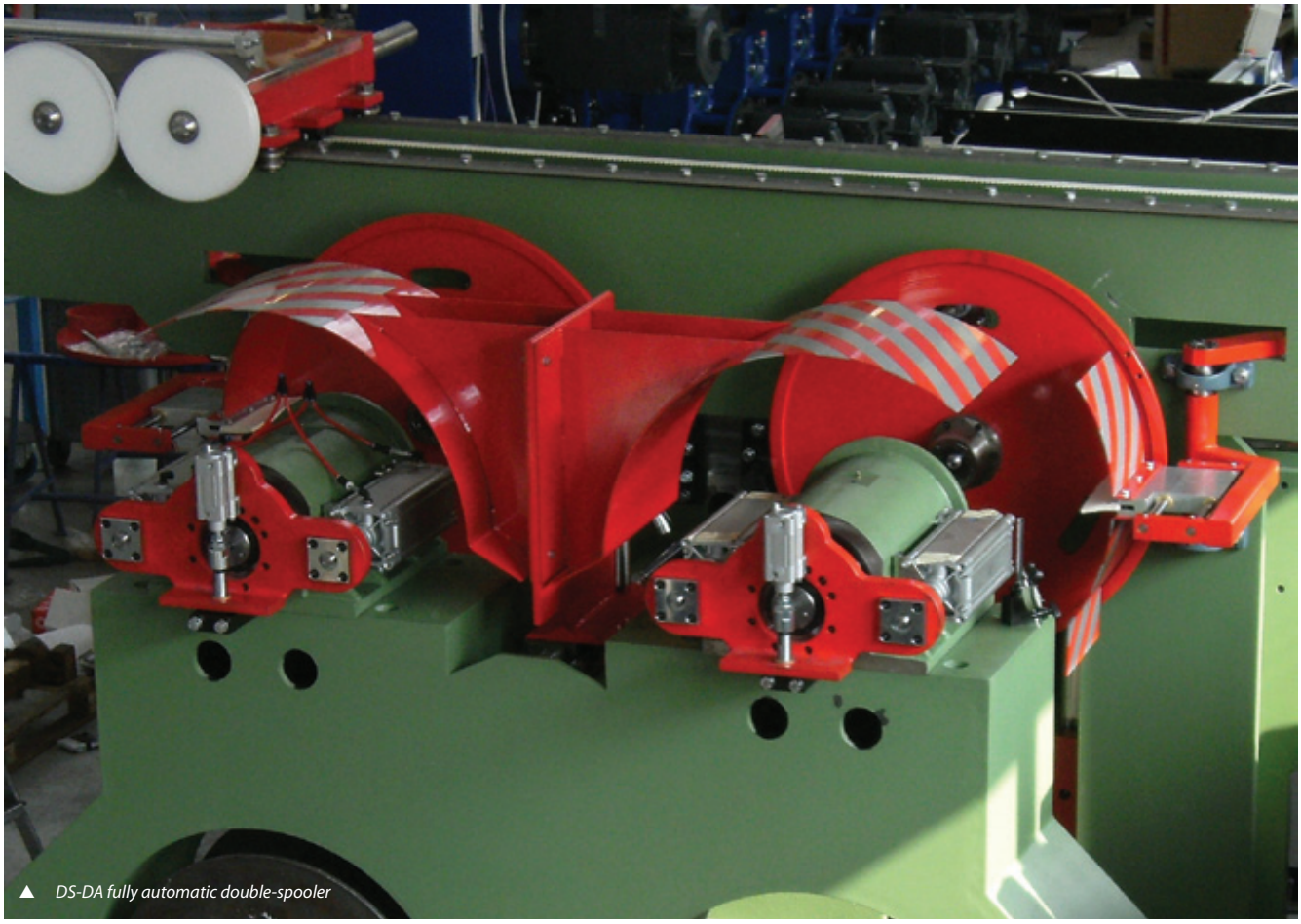
The company's aim was to give the operator a means to understand and oversee the forming process, tailoring the controls according to increasing needs and continuously improving the man-machine interface.

The technological know-how developed in cold forming allowed the company to create dedicated networks for production data collection and dimensional measurement acquisition systems. The shop floor data collection network enables complete control of data production in the directional centre of any manufacturing company specialised in cold forming, without time consuming manual intervention.

▲ *Helios 2K monitor*

To control production quality, Eldes software solutions guide and help the operator in the job of measuring produced parts, by directly providing all the necessary data and by obtaining all the documents the company system requires. The station structure plays an important role and is therefore part of the supply.

Eldes snc – Italy
Website: www.eldes.net



▲ DS-DA fully automatic double-spooler

Getting precise for the drawing and annealing machines

EUROALPHA produces precision machinery for the wire and cable industry, specialising in drawing machines for non-ferrous wires, with expertise in limited-slip technology.

The company aims to provide customers with top quality, user-friendly equipment for uninterrupted production and heavy working conditions, entirely designed and manufactured in Italy, along with prompt and complete proactive support.

The company produced its first limited-slip rod breakdown line for non-ferrous wires in 1993.

Other milestones include its first multi-motor continuous annealer in 2004; and in 2010, a patented four-twist bunching machine.

Euroalpha's design, based on low-inertia AC motors, state-of-the-art vector inverters and a special SW algorithm secures precision speed control through a maintenance-free system.

It positively affects operations and maintenance, improves the quality of the finished wires, and contributes to reducing running costs, by reducing energy consumption and extending the working lifespan of many wearing parts.

It also features low-noise operation without soundproof cabinets, and provides great operational flexibility of the drawing machine, for optimal use with different materials.

The R1 compact, limited-slip rod breakdown machine is suitable for drawing copper, aluminium and aluminium alloy wires.

With capstans arranged onto two superimposed rows it has a total length shorter than 5m. The company states that it performs at the same rate as conventional straight-line rod breakdown machines.

The DS-DA fully automatic double-spooler is designed to perform automatic changeover from full to empty reels, with speeds up to 30m/sec.

A simple and effective X-Y hydraulic elevator provides automatic loading/downloading of the reels from two motor driven conveyors.

Euroalpha's D3 limited-slip multiwire drawing machine is suitable for drawing copper, aluminium and aluminium alloy, and CCA wires, and is claimed to be the first multiwire drawing machine to be designed with individually motor-driven drawing capstans.

It can be combined with the AM-series annealers, with multi-motor technology to minimise the slip at any diameter of wire, and equipped with enhanced systems for cooling and drying the wires. AM annealers ensure uniform mechanical and electric properties over all the finished wires.

Euroalpha Srl – Italy
Website: www.euroalpha.it

New patents for cable industry

Macchine Speciali Srl has patented and is developing some innovative features.

The first patent relates to stranding, while the second is a multiple degrees of freedom pulley, simply called 'free-pulley'. The company says that this application is giving good results where used, and recently showcased the concept at wire 2012 Düsseldorf.

The two patents, filed at the Chamber of Commerce of Lecco, are also to receive an award from the Italian government authorities from the Ministry of Economic Development.

Macchine Speciali Srl – Italy
Website: www.macchinespeciali.it

Evolution of wire enamelling

▲ *Nuova Tecno Tau's new enamelling equipment*

NUOVA Tecno Tau Srl has designed a new line of wire enamelling machines named Evo, as an evolution of traditional ovens.

The Evo oven and the new Ecoplate catalytic plate allow solvents to be burnt at low temperatures in the catalyst group, and the air sent to the stack pipe at low temperature, with a consequent reduction in energy consumption, and maintaining air pollution under the European Standards.

The new Evo line is divided into different wire ranges, from Ø 0.2 to 1.5mm round wire, and flat wire from 10 to 100mm^2.

Nuova Tecno Tau Srl – Italy **Website**: www.ntecnotau.com

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Surface
Treatment

Cleaning

Pickling

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Tel: +39 0362 573197 Fax: +39 0362 576138
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http://www.siriowire.com

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We are specialists in designing and manufacturing ***molten salt bath ovens*** for cable heat treatment technologies. Our molten salt bath equipment guaranties a high production rate, product quality and uniformity, convenience and reliability for many years. We have the following equipment available:

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There are no disposal problems with our salt recovering **REC** type equipment

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VIA VAL CAFFARO, 1 – I20134 – MILANO
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Cold forming mechanical transfer press

INVERNIZZI Presse's 12,000kN GNLMt2 1600–750 knuckle joint transfer press with advanced control system allows an easy connection of the press to the complete production system, to provide completely automatic equipment.

The press can incorporate options such as out-going table, for an easy and fast tool exchange, lower and upper ram extractions, and 2D and 3D transfer. The flexibility of the equipment allows it to be used in a wide range of applications.

Advantages include low cost of tool material; low forming speed; no costs for material heating; no material tolerance problems due to material restriction; improved surface and mechanical characteristics of finished parts; high production rate; and longer tool life.

The press linkage is composed of a modified knuckle joint with added link points, while the press frame is produced in separate stress relieved welded steel units assembled by cold preloaded tie rods (hydraulic controlled system). Oversizing of the frame and control drive system ensures maximum static and dynamic rigidity. The control panel uses a Siemens MP 277 TFT touch-screen.

The ram is guided with special pre-charged clearance free roller guides. This system ensures accuracy and efficiency even with displaced load, as well as low working friction.

Invernizzi Presse Snc – Italy
Website: www.invernizzi.com

▶ *Invernizzi Presse's cold forming system*

More to green than just the colour!

OM Lesmo Group has been manufacturing rotating equipment in Italy since 1962. Its chosen machine colour is green, but there is more to the machines than the colour green.

Since the production of the very first rotating machine, OM Lesmo engineers have incorporated energy savings as an intricate part of their machine design.

OM Lesmo claims to be the first company to introduce and patent single bow design in its double twist machines instead of the traditional design with two bows. This design not only allows higher rotating speeds, but also results in energy savings.

The single bow technology is also used in some of the single twist machines, where a single rotating arm is used instead of the traditional two-arm design. By using only one bow or arm, the inertia is reduced and the energy needed to rotate is also reduced. The bow path is designed in a very efficient aerodynamic shape to reduce the wind resistance.

The single bow concept is also adopted in the company's latest 1,250mm single twist machine, MTO1250-CT.

The use of an aerodynamic, carbon fibre, single-arm design not only allows higher rotating speeds, but also saves energy.

Officine Meccaniche di Lesmo SpA – Italy
Website: www.omlesmo.com

A new concept in backtwist feeders

WTM, based in Padova, Italy, specialises in equipment for the wire industry, and has enhanced the process of single stranding with its single twisting machines coupled with its new-concept concentric backtwist feeders.

The formation of high quality, sophisticated cables (highest CAT number) is made easier: the rotating dancers control with high accuracy the tension of the cable to be twisted, at the outlet of the backtwist feeder.

The pre-torsioned cables go in stranding directly without touching anything else, ie pulleys, dancers, etc. In this way the lay-length is constant and without any disruption, thus achieving the highest level of final strands.

One of the most relevant characteristics of this new concept of single twisting line is the productivity increase, claimed to be more than two times that of traditional 'cage' backwist feeders.

The single torsion unit can work up to 1,200 rpm (torsions); in combination with the newly developed backtwist feeder, it is possible to obtain 100% backtwisted strand at 600-700 rpm.

Another advantage is the compactness of the system, which allows a complete 12+1 twisting line in less than 17m, saving precious space in the workshop.

All of the machines composing the twisting lines have no electric parts in rotation, and every motor, control and regulation card is placed in a stable, fixed base, reducing any possible maintenance.

The line can be completed with other WTM equipment, such as tape applicators, binders and compacting dies. Mechanical tests of the cables can also be carried out using WTM's testing equipment.

WTM Srl – Italy
Website: www.wtmachinery.com

Wire cleaning technology

Serindgamma produces washing-salting and pickling plants, and specialises in in-line cleaning machines with both mechanical and chemical operations. The machines are entirely manufactured in the company's factory in Magenta, Milan.

The flexibility of the company's technical departments to study and manufacture customised solutions, using tested technology in order to solve problems linked to wire and cable production, has brought the company commissions from all over the world.

The plants are normally equipped with the latest generation ultrasound technology, controlled by microprocessor, that works with several frequencies for simultaneous cleaning of aluminium and stainless steel wires without any risk of damaging the surface.

These plants are composed of multi-tank washing-solutions; the number and dimension of the tanks is determined by the treatment and chemical process required, and the process speed. Additional air blowing and/or heating treatment for drying the wires ensures a perfectly cleaned surface, in order that the wire reaches the post-operations completely dried. The machines are able to treat up to 26 wires in-line.

Serindgamma Srl – Italy
Website: www.serindgamma.com

Pickled/annealed welding wires

Italfil SpA, with offices in Gazzo Padovano, Italy, is a family-owned company founded in 1978 for the manufacture of standard mild solid steel welding wires.

The company now not only manufactures in mild steel, but also specialises in the production of low alloy and hard-facing solid steel welding wires with special chemical pickling and personalised annealing processes, if requested. TIG, MIG and MAG sub-arc wires are manufactured for manual and robotic welding according to CE parameters and within international specifications. The company is certified ISO 9001-2000.

Italfil SpA – Italy
Website: www.italfil.com

◄ *Italfil's offices in Gazzo Padovano*

Lubricants and chemicals

LUBRIMETAL is a chemical company specialising in the production of lubricants and other chemicals for wire drawing and metal surface treatments. The company's specialised production process was developed by its own in-house engineers. This patented process is combined with a full range of sophisticated analysis equipment, to ensure performance and quality.

The company's portfolio includes Lubrifil powder drawing lubricants (calcium based dry drawing lubricants, sodium based dry drawing lubricants, other dry lubricants, and Borax- and nitrite-free lubricants); Lubriol oils and greases for wet wire drawing; Fosfil phosphate coating agents and other chemical products for treating metal surfaces; Steelfor lubricant carriers for the surface treatment of carbon and stainless steel wire and rod and Borax-free coatings; and Additives LM pickling and corrosion inhibitors, special additives and auxiliary items for steel wire drawing and other cold forming operations.

In carrying out its production, Lubrimetal pays particular attention to the safety of the workplace, to the saving of energy resources, to the reduction of risks, atmospheric emissions and noise, and to the recovery and disposal of waste. The company was one of the first to develop industrially applicable formulations free of borates and other dangerous substances.

Its strategic development is based on the principle of total quality in accordance with the regulations of ISO 9001 (since 1993), 14001 (since 1995) and OHSAS 18001 (since 2000). The company's mission is to assist customers in obtaining maximum technical performance using suitable and, where necessary, personalised products.

Lubrimetal technicians can help customers by advising them on the most suitable lubricant, the most efficient production technology, and solutions to optimise the rate of production and achieve the highest quality. The company's chemists cooperate with the technical sales department and with customers to develop new products and to test residuals before and/or after the drawing processes and for other specialised analyses. The company has a sophisticated laboratory, available for research and development, internal quality checks and customer assistance.

Lubrimetal SpA – Italy
Website: www.lubrimetal.com

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Please contact: Mr Michel Landman
E-mail: michel.landman@wiresteel.be
Website: www.wiresteel.be

Specialising in wire surface treatment

SIRIO Wire Srl specialises in the production of wire surface treatment lines. Its production range includes HCl fumeless pickling, H_2SO_4 electrolytic pickling, ultrasonic and electrolytic cleaning, electro-plating lines, bronzing lines for beadwire, phosphating, coating and drying.

Demand for cleaning processes in the wire industry is continuously increasing, along with increased quality requirements. Ultrasonic cleaning allows the removal of products present on the surface of the wire, such as calcium and sodium stearate lubricant coming from the dry drawing machine, lubricant oil from the wet drawing machine, phosphate coating and others.

The main applications can be found in the field of stainless steel wires, oil tempered wires prior to heat treatment, carbon steel wires prior to galvanising, and aluminium alloy wires.

▲ *Cleaning technology from Sirio*

Ultrasonic cleaning is the use of high frequency sound waves. In the activity called cavitation, micro-sized bubbles form, grow and implode due to alternating positive and negative pressure waves. Just prior to each bubble's implosion, there is a tremendous amount of energy stored inside the bubble itself. The implosion event, if it occurs near a hard surface, changes the bubble into a jet, which travels at a speed of approximately 400km/h towards the hard surface. Because of the inherent small size of the jet, ultrasonic cleaning has the ability to reach into small crevices and removed entrapped soils very effectively.

The basic components of an ultrasonic cleaning system include ultrasonic transducers, an electrical generator and a tank containing the cleaning solution. The ultrasonic generator converts a standard electrical frequency of 50 or 60Hz into the high frequencies required. The higher the frequency, the smaller the bubbles created during the cavitation will be.

The transducers are constituted of PZT elements (Pb-Zr-Ti) that convert the electrical energy in mechanical vibrations by piezoelectric action. The transducers are installed inside a watertight box made of stainless steel, immersed in the cleaning bath and located some centimetres below the wire field. A watertight cable connects the transducer holding box to the generator.

After the cleaning operation, it is necessary to thoroughly rinse the wire in order to remove the chemical residuals. Sirio Wire has developed a special system working with water under pressure to allow the best rinsing effect. All Sirio Wire equipment is fitted with special mechanical drop traps and effective air wiping devices to minimise the liquid drag out.

Sirio Wire Srl – Italy
Website: www.siriowire.com

Cleaning and plating technology

Otomec Srl engineers and manufactures customised cleaning and plating plants for the wire, cable and strips industry. The company can provide a wide range of machines, sized to process small volumes of product as well as large outputs, single-multi strand, reel-to-reel, and speeds up to 20m/sec.

OTO 5 is a modular, multi-functional plant for in-line preparation of iron wire rod, patented and awarded by the European Community for innovative features, while OTO 4 is a complete plant for the electroplating of steel and non-ferrous wire.

The OTO'FF line is a reel-to-reel or basket plant for copper, brass, stainless steel, carbon steel, superconductor, alloys and fine tubes. The model OTO 2 performs in-line coppering of up to 5mm wire, at speeds of up to 20m/sec. The company also produces compact plants for environmental treatment (water, steam) and auxiliary plants.

Otomec operates worldwide, providing exclusive technology as a result of almost one hundred years of experience in the field.

Otomec Srl – Italy
Website: www.otomec.it

Effect of Boron alloying on microstructural evolution and mechanical properties of high carbon wire

By Emmanuel De Moor, Advanced Steel Processing and Products Research Centre, and Walther Van Raemdonck, NV Bekaert SA

Abstract

Boron alloying is frequently applied in low carbon steel to tie up free nitrogen and prevent strain aging resulting in improved (torsional) ductility of wire products. The present contribution investigates boron alloying effects in high carbon (0.80 wt pct) steels. Laboratory heats were prepared with boron to nitrogen ratios of 1:1 and 2:1 in addition to a reference heat.

The material was hot rolled, drawn, patented and further drawn to 1mm. Mechanical properties were assessed along with microstructural characterisation at each intermediate stage. Limited effects of boron alloying on mechanical properties are apparent.

Introduction

Electric arc furnace steelmaking is increasingly employed, especially in North America, for steel making operations of long products.

The substitution of rimming steel by continuous cast electric arc furnace (EAF) steel imposes challenges on meeting product quality requirements in particular with respect to (torsional) ductility. This relates to the inherently higher nitrogen content of EAF steel. If the nitrogen is mobile, it can cause strain aging resulting in increased work hardening and reduced ductility of the wire product[1].

Significant research has been conducted to reduce the free nitrogen content of low carbon wire rod grades by alloying with micro-additions of eg boron, vanadium or niobium.[1-6]

Boron alloying of high carbon steel has received less attention[7] and is the focus of present research.

Experimental Procedure

Boron can combine with nitrogen to form boron nitride according to

$$B + N = BN \quad (1)$$

and stochiometry corresponds to a B:N ratio of 11:14 or 0.79 given the atomic weights of boron and nitrogen.

Three alloys, with a carbon content of 0.80 wt pct, were designed in current research to have a reference alloy, an alloy with boron and nitrogen in a stochiometric ratio and one superstochiometric alloy with a B:N ratio of 2:1. The latter steel enables a study of the effect of the additional "free" boron on microstructural development and properties.

The compositions of laboratory prepared ingots are shown in *Table 1* and it should be noted that the ratios in the as-cast compositions were somewhat higher than designed, namely 1.44 and 2.39 respectively in the B and High B alloys. Free boron may hence also be present in the B alloy.

The ingots were hot rolled on a hand charged rolling mill with reheating done at 1,176°C and reduction carried out in three steps on two hot rolling mills.

Initially the bars were reduced from 12.7 to 9.5cm round corner square (RCS) followed by air cooling to room temperature, reheating and rolling to 4.76cm.

The material was then machined to remove oxides and cut in 6 – 7 blocks. Final reduction was carried out on a second hot rolling mill to a final size of 7.1mm.

The material was ambient air cooled after hot rolling. The material was then saw-cut to 3.7m lengths, prior to drawing. Twenty-four sections were obtained for each alloy.

▼ **Table 1**: *Chemical composition in wt pct of the laboratory prepared steels*

	C	Mn	Si	Cr	B, ppm	N, ppm
Base	0.78	0.48	0.25	0.20	-	42
B	0.82	0.46	0.23	0.20	62	43
High B	0.76	0.47	0.23	0.20	98	41

Although Thermo Calc® thermodynamic calculations predicted a potential for hot shortness in the High B steel, no breakage or significant surface defects were observed.

As significant decarburisation was observed,[8] the material was centreless ground to 5.5mm diameter.

The hot rolled rods were then assessed for carbon segregation and only those rods with a carbon content of 0.78 ± 0.01 wt pct were retained for further wire drawing.

Wire drawing was carried out at the Bekaert Technology Centre and involved reduction to 2.5mm diameter in eight drawing steps.

Patenting was then conducted in salt baths with reheating at 980ºC followed by 520ºC. The patented wire was then further drawn to 1mm.

Tensile testing was conducted on an electro-mechanical tensile machine at a constant strain rate of 5.6 10^{-4} /s, with a 5cm 50% extensometer.

Two samples were tested for each condition. Uniform strains were determined as the engineering strain at the peak load used for UTS calculations, and total strains to failure were obtained from the extensometer output at final fracture.

All samples were observed to fail within the specified extensometer gauge length unless otherwise stated.

Microstructural characterisation was done by light optical microscopy on 4% Picral etched samples and by transmission electron microscopy (TEM) on a Philips CM120 instrument operating at 120kV.

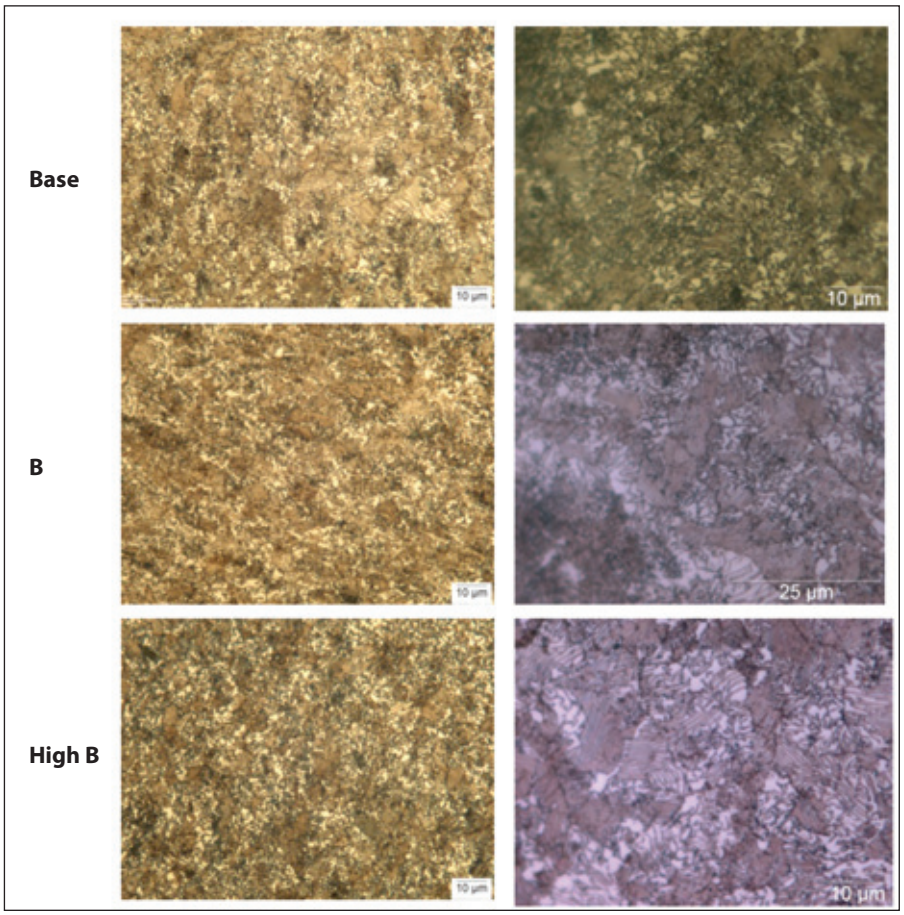
Thin foils were electropolished with a Fischione twin-jet polisher operating at 32V at room temperature, using a mixture of 95 pct acetic and 5 pct perchloric acid.

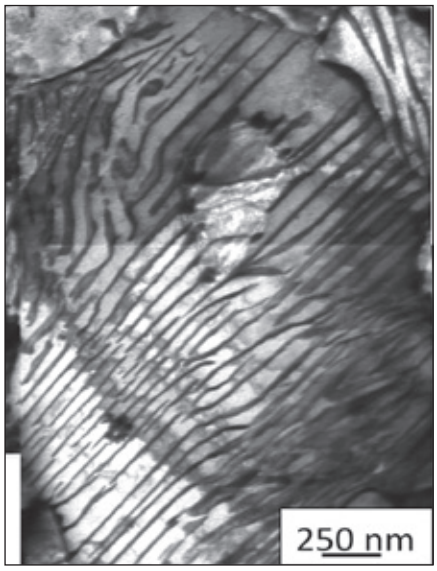
Dilatometry was carried out on a Gleeble® 1500 system. Samples were reheated to 950°C at a constant heating rate of 20°C/s and held isothermally for five minutes.

The steel was then cooled in helium gas at programmed constant cooling rates of 50, 30, 25, 12.5, 10, 7.5, 5, 2.5 and 1°C/s, respectively.

Consecutive tests were conducted on a single specimen per alloy.

▼ **Figure 1**: *Light optical micrographs of hot rolled rods Base, B and High B steels. Samples taken transverse to the rolling direction, in the centre of the cross section, 4% Picral etch*





▲ **Figure 2**: *Transmission electron micrograph of the hot-rolled and air cooled high B material*

The dilation of the sample was monitored with temperature and time.

Results and Discussion

Light optical micrographs taken in the middle of the cross section of the hot rolled rods are given in *Figure 1*.

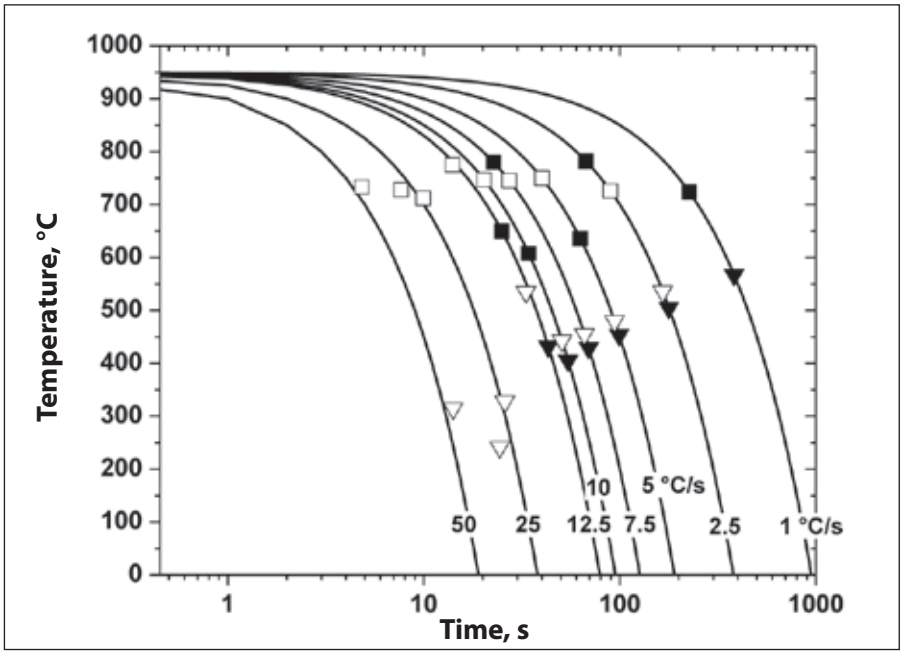
Pearlitic microstructures are evident. Pro-eutectoid constituent networks were not observed. TEM was conducted on the superstochiometrically alloyed steel to evaluate the effect of free boron on microstructural evolution and a representative TEM micrograph is shown in *Figure 2*.

Martensite was not detected, perhaps suggesting that the free boron did not increase hardenability. Boron is known to strongly increase hardenability in low carbon steels[9]. This effect has, however, been reported to be less pronounced in high carbon steels[10, 11].

In order to assess the alloying effect on hardenability, dilatometry was conducted on the base and B alloy as discussed in reference 12.

It was shown that the boron alloying resulted in decreased hardenability as shown in *Figure 3* where transformation start and finish temperatures are shown for the Base and B alloy on a temperature as a function of time plot. Various constant cooling rates were investigated as shown.

At cooling rates of 25 and 50ºC/s, martensite transformation was the only austenite decomposition mechanism detected in the Base alloy whereas pearlite transformation was observed in the B



▲ **Figure 3**: *Transformation start (squares) and finish (triangles) temperatures for different constant cooling speeds. Filled symbols: base alloy and open symbols: B steel*

steel. In addition, the B steel exhibited a larger pearlite transformation region.

Stress-strain curves and tensile properties of the hot rolled rods are given in *Figure 4* and *Table 2*.

The Base and B steels exhibit very similar stress-strain behaviours albeit that the B steel exhibits a yield point elongation (YPE) whereas the Base steel exhibits continuous (ie smooth, "round-house") yielding.

The occurrence of YPE might be somewhat unexpected as the alloy was designed to have nitrogen tied up to boron and the YPE should hence not result from "free" nitrogen strain aging. The behaviour hence presumably relates to carbon strain aging.

It should be recognised that the rods were straightened at room temperature following hot rolling, and non uniform strain during straightening may have led to removal of YPE in some cases. Similar tensile strengths and elongations were obtained in the Base and B steel.

The High B steel exhibited lower strength values; smooth yielding is observed at lower strengths compared to the other steels and an ultimate tensile strength value lower by about 25 MPa was obtained. This strength difference cannot be ascribed to carbon as samples with the same carbon content were selected for testing. A higher tensile elongation was exhibited by the High B steel.

It is interesting to note that reduced tensile strength with boron alloying is in agreement with earlier work on low1 and high7 carbon steels and is also in agreement with increased hardenability observed in the dilatometry study.

Increased pearlite transformation kinetics may lead to increased lamellar spacing and/or coarser pearlite. One might also argue that the reduced strength level may be related to reduced solid solution strengthening. It should however be recognised that the B alloy does not exhibit strength reduction compared to the Base.

It has been suggested previously that the strength reduction relates to an alloying effect on the austenite to ferrite1 or pearlite[11] transformation.

Mechanical properties following wire drawing to 2.5mm diameter are given in *Figure 5a* and *Table 3*.

In the drawn condition, the B steel exhibits the lowest tensile strength and elongation, the High B steel exhibits the highest tensile strength and higher elongation compared to the B steel.

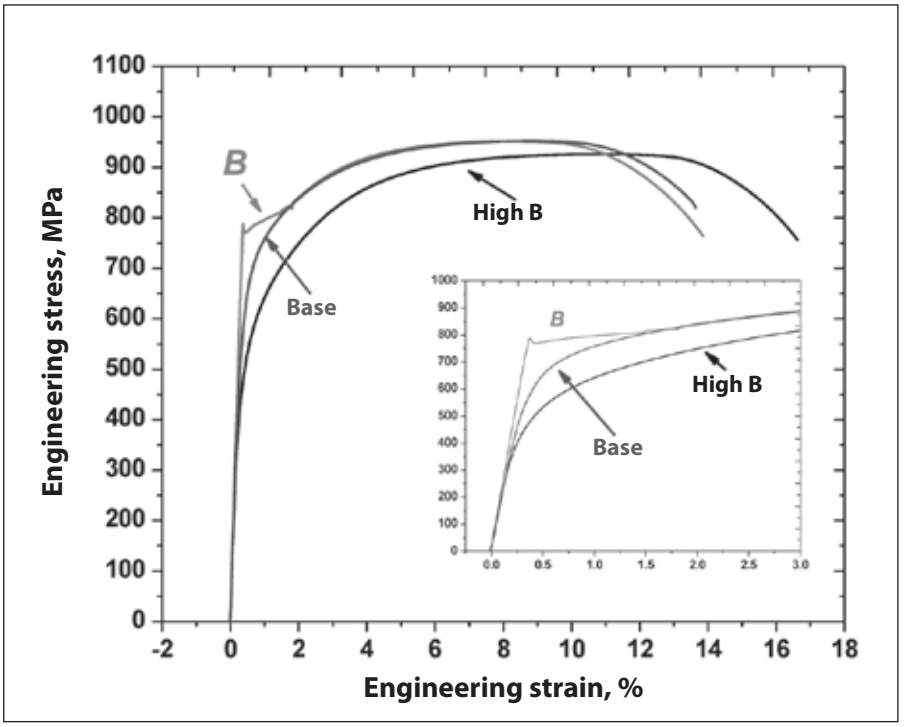
The Base steel exhibits similar uniform and total elongation compared to the High B steel albeit at a lower tensile strength. It should be recognised that failures occurred at the tensile grips which likely influenced the total elongation values.

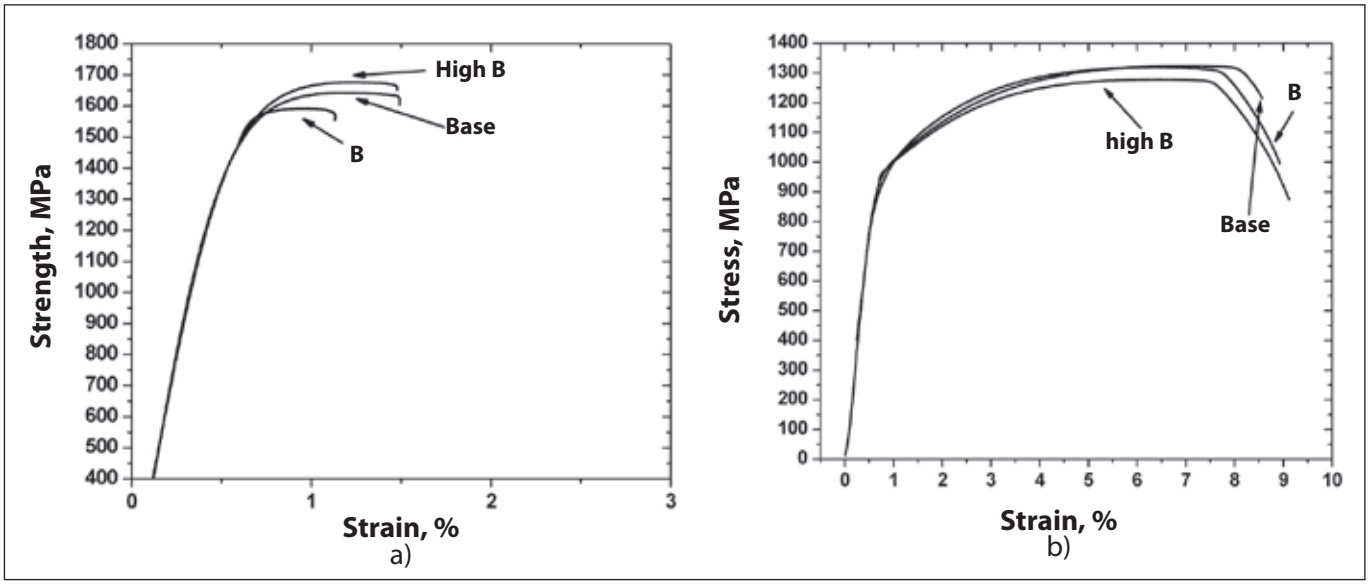
Tensile properties obtained after patenting at 2.5mm diameter are given in *Figure 5b* and *Table 3*.

▼ **Table 2**: *Tensile properties of the hot-rolled rods*

	UTS, MPa	UE, %	TE, %
Base	952	9.4	13.7
B	951	8.2	13.9
High B	926	11.2	16.6

▼ **Figure 4**: *Stress-strain curves of the hot-rolled rods*





▲ **Figure 5**: *Stress-strain curves of wire a) drawn to 2.5mm and b) patented at 2.5mm*

		UTS, MPa	UE, %	TE, %
Drawn to 2.5mm	Base	1644	1.2	1.5
	B	1592	1.0	1.1
	High B	1677	1.2	1.5
Patented at 2.5mm	Base	1324	7.3	8.6
	B	1317	6.7	8.9
	High B	1277	6.7	9.1

▲ **Table 3**: *Tensile properties Ultimate Tensile Strength (UTS), Uniform Elongation (UE), and Total Elongation (TE) of the wires drawn to 2.5mm and patented at 2.5mm*

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2106	1.1	2.1	41	12
B	2096	1.3	2.4	42	11
High B	2087	1.4	2.5	41	9

▲ **Table 4**: *Tensile properties Ultimate Tensile Strength (UTS), Uniform Elongation (UE), and Total Elongation (TE) of the wires drawn to 1mm after patenting*

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2263	0.4	1.5	35	11
B	2283	0.4	1.5	36	10
High B	2257	0.4	1.5	36	8

▲ **Table 5**: *Tensile properties Ultimate Tensile Strength (UTS), Uniform Elongation (UE), and Total Elongation (TE) assessed following aging at 150 ºC for one hour of the wires drawn to 1mm after patenting*

Similar tensile strengths are obtained in the Base and B steel whereas the High B steel exhibits an ultimate tensile strength lower by about 50 MPa.

This lower strength value may again be related to increased austenite decomposition kinetics. Slightly higher total elongation is obtained for both boron containing steels.

The patented wires were subsequently drawn to 1mm diameter in consecutive passes and resultant tensile properties in addition to number of twists to failure (Nt) and number of reverse bends (Nb) are given in *Table 4*.

A decrease in tensile strength with boron alloying is again apparent along with a slight increase in uniform and total elongation. The number of twists to failure is however not altered by the alloying whereas a slight decrease in number of reverse bends is observed with increased boron levels.

In order to assess aging response of the 1mm drawn wire, isothermal aging was conducted at 150ºC for one hour and the results are given in *Table 5*.

A tensile strength increase by about 170MPa is obtained whereas tensile elongations are reduced to 0.4% uniform and 1.5% total elongation. Similar elongations were obtained in all alloys.

Similar twists to failure were again observed in all alloys albeit at lower levels as for the unaged material.

The trend of reduced reverse bends with increased boron levels is again observed in the aged condition and about one bend less is obtained in the aged condition versus the unaged condition for all steels.

This suggests that the boron alloying does not affect ductility significantly at the levels of nitrogen investigated.

It should be noted that the nitrogen levels of the present heats of approximately 40ppm are on the lower end of industrially produced material.

Conclusions

The effect of boron alloying of 0.80C steels to tie up "free" interstitial nitrogen was investigated.

Heats with B:N ratios of 1.4 and 2.4 in addition to a base alloy without boron were laboratory prepared, hot-rolled, drawn, patented and further drawn to a final diameter of 1mm.

Microstructural characterisation was conducted and tensile properties were assessed.

Limited effect of boron alloying was apparent at the investigated nitrogen levels on wire properties in particular torsional ductility.

Reduced ultimate tensile strength was observed in the High B steel. ■

Acknowledgements

The International Wire & Machinery Association Educational Trust Fund is gratefully acknowledged for financial support as well as The Timken Company for supplying the laboratory prepared steels.

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Dätwyler verkabelt neues Rechenzentrum des Landschaftsverbands Rheinland

▲ *Das neue Rechenzentrum von Dätwyler*

UM seine Aufgaben besser erfüllen zu können, hat LVR-InfoKom, das Systemhaus des Landschaftsverbandes Rheinland, sein zentrales Rechenzentrum in Köln, Deutschland, erweitert und in einen Neubau ausgelagert. Der Auftrag für die Neuverkabelung ging an Dätwyler, die eine wirtschaftliche Gesamtlösung und schnelle Erledigung bieten konnte.

Im Jahr 2009 beschloss LVR-InfoKom, eines seiner beiden Rechenzentren zu vergrößern und in einen Neubau auszulagern, das neben dem Rechnerraum auch mehrere Funktionsräume umfasst. Im neuen Rechenzentrum sollten alle aktiven Komponenten mit einer zukunftssicheren Top-of-Rack-Verkabelung miteinander verbunden werden.

Im Bereich Kupfertechnik wurde deshalb ein 10-Gigabit-fähiges Klasse EA-System ausgeschrieben. Im Glasfaserbereich wollte der LVR OM3-Multimode-Kabel und – für die Anbindung nach außen – OS2-Singlemode-Kabel in Bündeladerkonfektion, die mit Kabelaufteilern und vorkonfektionierten LCD-Anschlüssen geliefert werden sollten.

Neben den Abnahmemessungen und einem Funktionstest der Verkabelung wurde eine Systemgarantie über 20 Jahre und eine vollständige Dokumentation gefordert, die auch die Anbindung der aktiven Komponenten beinhalten musste. Außerdem umfasste das erweiterte Verkabelungsprojekt den Bau der Kabeltrassen, die Brandabschottung zwischen den Räumen und die Einhausung der Kabeltrassen im Korridor.

Den Zuschlag dafür erhielt Dätwyler. „Das Angebot von Dätwyler hat uns nicht nur durch eine sehr wirtschaftliche Lösung, insbesondere für die Glasfaserstrecken überzeugt, sondern auch durch einen plausiblen Plan, wie sich die sehr knappen Installationszeiten einhalten lassen“, erklärt Michael Kemper, Leiter Kommunikationstechnik bei LVR-InfoKom.

Dätwyler realisierte den Auftrag in Turnkey-Verantwortung. Innerhalb weniger Tage konnten die Teams von Dätwyler die Kupferkabel des Typs 7702 einziehen, mit Steckern konfektionieren und die etwa 1000 Strecken mit 16 Kilometern Gesamtlänge abschließend messen und dokumentieren. Die vorkonfektionierten LWL-Trunkkabel (Mehrfachkabel) – insgesamt 210 Strecken, zumeist mit je 24 Fasern – kamen inklusive der Messprotokolle in mehreren Teillieferungen und wurden jeweils umgehend installiert.

Die verbauten Systeme umfassen weiterhin 1500 Patchkabel in Kupfer- und Glasfasertechnik, 400 Patchpanel und Rangierfelder sowie rund 200 optische Verteilerfelder.

Dätwyler – Deutschland
Website: www.datwyler.com

Investment um die Produktion zu rationalisieren

Hutchinson Engineering of Widnes, Cheshire, UK, investiert über 500.000 britische Pfund in die Entwicklung neuer Techniken, um seine Leistung bei der Herstellung von Mobiltelefonmasten und Windkraftkonstruktionen zu rationalisieren.

Die neue Ausrüstung von Ficep – bestehend aus einer 370.000 britische Pfund werten, in Italien hergestellten Gemini-Maschine für das Bohren, Gewindeschneiden, Fräsen, Markieren und thermische Schneiden von Stahl, und einer 140.000 britische Pfund werten, dänischen PC600-Maschine für das Rohrprofilieren – wird die Fertigungs- und Schneidverfahren beschleunigen, in dem Qualitätsteile mit einer besseren Passung und niedrigen Schweißzeiten hergestellt werden.

Dank dieser neuen Maschine wird das Unternehmen größere Windkraftanlagen leichter herstellen können, bzw. 50kW- und 100kW-Modelle. Außerdem wird diese Maschine die Herstellungs- und Lieferzeiten der Basisplatten für Telekommunikationsmasten erhöhen, die für O2 und Vodafone bestimmt sind.

Hutchinson Engineering – UK
Website: www.hutchinson-engineering.co.uk

DNA-Technologie beabsichtigt Einbrecher zu besiegen

EIN revolutionäres, tragbares Alarmsystem, das Einbrecher filmen kann sowie mit Einsatz der DNA-Technologie Täter aus abgelegenen Standorten mit Verbrechen in Verbindung bringen kann, wurde von der Polizei als ein großer Schritt bezeichnet, das bei der Bekämpfung der gewaltigen Zunahme von Metalldiebstählen sehr hilfreich sein kann.

Das von PID Systems in Kilmarnock, Schottland, entwickelte AATTS-System (Alarmed and Traceable Technology Solutions System), ist das erste zweckdienliche Alarmsystem zum Schutz gefährdeten Eigentums und Standorten, das vom Verband der Polizeipräsidenten (Association of Chief Police Officers - ACPO) genehmigt und empfohlen wird.

Das System ist kabellos und daher ist ein Anschluss ans Stromnetz nicht erforderlich. Außerdem kann es schnell und leicht installiert werden. Es klingelt, wenn ein Einbrecher erfasst wird, sendet dem Gebäudeeigentümer und PID Systems ein Signal und nimmt auch jeden versuchten Diebstahl auf Video auf.

Die vandalensichere Vorrichtung wird in Verbindung mit einem waschfesten roten Ultraviolett- (UV) Farbstoff eingesetzt, der nur unter UV-Licht sichtbar ist. Es bedeckt den Einbrecher mit einem einzigartigen, verschlüsselten molekularen Markierungsstoff, der an den Tatort zurückverfolgt werden kann.

Es gab einen gewaltigen Zuwachs bei Metalldiebstählen, der durch eine Erhöhung der weltweiten Kosten veranlasst wurde. Der Kupferpreis stieg von 889 britische Pfund Jahr/Tonne in November 2001, zu 6.356 britischen Pfund Jahr/Tonne, die letztes Jahr verzeichnet wurden. Entsprechend HM Revenue and Customs, gehen mit 10.000 bewerteten Vorfällen von Metalldiebstählen jährlich in der UK-Wirtschaft über 5,6 Milliarden Erträge verloren.

Darunter ist Network Rail am meisten vom Kupferdiebstahl betroffen, bei denen die Diebstähle von Eisenbahnkabeln um 65 Prozent zunahmen, was zwischen 2009 und 2010 zu 16.000 verlorenen Arbeitsstunden führte, und bei BT stiegen die Kabeldiebstähle letztes Jahr um 12 Prozent.

Graham Jones, Abgeordneter für Hyndburn, hat einen privaten Gesetzentwurf für die Verhütung von Metalldiebstählen, "Metal Theft Prevention Bill", im britischen Unterhaus eingeführt, das sich bemüht die Bestimmung zu verschärfen, einschließlich eines robusten Lizenzschema für Schrottplätze. Eine gesonderte Gesetzgebung wird in Schottland einzuführen sein.

PID Systems – UK
Website: www.pid-systems.co.uk

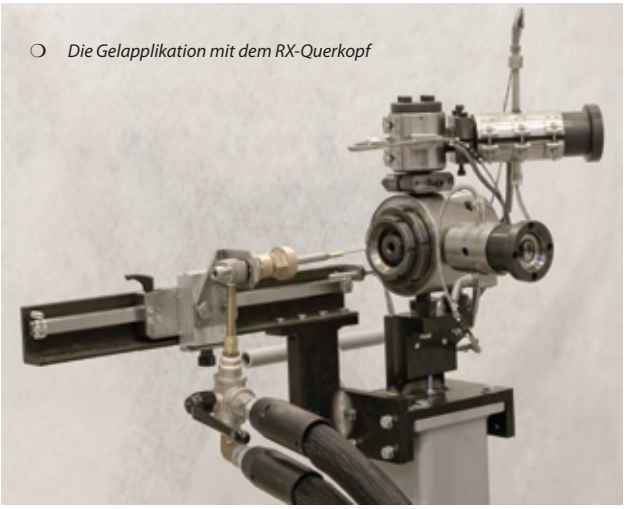
Rosendahl deckt den Bedarf

Das Prinzip gelgefüllter Lichtwellenleiterkabel hält weiterhin einen wesentlichen Prozentsatz innerhalb des LWL-Kabelmarkts. Die RX-Querköpfe von Rosendahl decken diesen Bedarf durch ein optional verfügbares modulares Gel-Injektionssystem mit leicht austauschbaren und einstellbaren Nadeln, die auf eine Linearführung mit hoher Präzision montiert sind.

Eine konstante Versorgung von Werkstoffen aus thixotropischem Gel und ein perfekt ausgeglichener Polymerfluß innerhalb des RX-Querkopfverteilers sichern eine kontinuierliche und stabile Verbreitung der LWL-Kabelmischung durch die Auslaufzone.

Die RX-Querköpfe von Rosendahl bieten in der Regel eine hohe Zentrierpräzision und sind daher eine Schutzvorrichtung gegen überdimensionierte Kabelwanddicke und bieten eine Unterstützung dabei Material- und Produktionskosten einzusparen.

Eine erhöhte Fließkanalgeometrie passt sich der Rheologie von Sondermantelmaterialien an, sichert kurze Verweilzeit des geschmolzenen Polymers und ermöglicht einen schnellen und einfachen Wechsel der Farbe oder des Materials. Ein kompakter



❍ *Die Gelapplikation mit dem RX-Querkopf*

und modularer Entwurf sowie eine bequem verfeinerte Zentrierung ermöglichen eine einfache Handhabung.

Der RX-Querkopf von Rosendahl schützt gegen Prozessabweichungen und hilft bei der Erhöhung der Qualität und Effizienz in Extrusionslinien für gelgefüllte LWL-Kabel.

Rosendahl – Österreich Website: www.rosendahlaustria.com

Wirkung der Bor-Legierung auf die mikrostrukturelle Entwicklung und die mechanischen Eigenschaften des hochgekohlten Drahts

Von Emmanuel De Moor, Advanced Steel Processing and Products Research Centre, und Walther Van Raemdonck, NV Bekaert SA

Zusammenfassung

Bor-Legierung wird öfter bei niedergekohltem Stahl eingesetzt, um freien Stickstoff zu binden und Deformationsalterung zu vermeiden, wobei eine erhöhte (Torsions-) Duktilität der Drahtprodukte erzielt wird.

In der vorliegenden Arbeit wird die Wirkung der Bor-Legierung auf hochgekohlten (0,80 Gew.-%) Stahl untersucht. Vorbereitet wurden Laborschmelzen mit Bor-Stickstoff-Verhältnissen von 1:1 und 2:1 in Ergänzung zu einer Bezugsschmelze.

Das Material wurde warmgewalzt, gezogen, patentiert und weiterhin auf 1mm gezogen. Die mechanischen Eigenschaften wurden zusammen mit der mikrostrukturellen Charakterisierung bei jedem Zwischenzustand bewertet.

Eingeschränkte Wirkungen der Borlegierung auf mechanische Eigenschaften sind offensichtlich.

Einleitung

Die Stahlerzeugung im Lichtbogenofen wird vor allem in Nordamerika für Stahlwerkbetriebe von Langprodukten zunehmend eingesetzt. Das Ersetzen von unberuhigtem Stahl mit Stranggießstahl im Lichtbogenofen (EAF) führt zu auferlegten Herausforderungen bei der Erfüllung der Produktqualitätsanforderungen insbesondere in Bezug auf (Torsions-) Duktilität.

Das hängt mit dem inhärent höheren Stickstoffgehalt des EAF-Stahls zusammen. Wenn der Stickstoff mobil ist, kann dies eine Deformationsalterung verursachen, was wiederum zu einer erhöhten Verfestigung und einer reduzierten Duktilität des Drahtprodukts führt.[1] Wichtige Forschungen wurden durchgeführt, um den freien Stickstoffgehalt der niedriggekohlten Walzdrahtklassen durch die Legierung mit Mikrozusätzen, wie z. B. Bor, Vanadium oder Niob, zu reduzieren. 1[-6]

Der Borlegierung des hochgekohlten Stahls wurde weniger Aufmerksamkeit geschenkt.[7] Die vorliegende Forschung fokussiert sich darauf.

Versuchsverfahren

Bor kann sich mit Stickstoff verbinden um Bornitrid zu bilden, entsprechend

$$B + N = BN \qquad (1)$$

und die Stöchiometrie entspricht einem B/N-Verhältnis von 11:14 oder 0,79 abhängig davon ob die relative Atommasse von Bor oder Stickstoff betrachtet wird. Drei Legierungen mit einem Kohlenstoffgehalt von 0,80 Gewicht-% wurden in der vorliegenden Forschung vorgesehen, um eine Referenzlegierung zu haben sowie eine Legierung mit Bor und Stickstoff in einem stöchiometrischen Verhältnis und eine superstöchiometrische Legierung mit einem B/N-Verhältnis von 2:1. Der letztere Stahl ermöglicht eine Studie über

▼ **Tabelle 1** – *Chemische Zusammensetzung in Gewicht-% des im Labor vorbereiteten Stahls*

	C	Mn	Si	Cr	B, ppm	N, ppm
Basis	0.78	0.48	0.25	0.20	-	42
B	0.82	0.46	0.23	0.20	62	43
Hochborhaltig	0.76	0.47	0.23	0.20	98	41

die Wirkung des zusätzlichen "freien" Bor bei mikrostruktureller Entwicklung sowie mikrostrukturellen Eigenschaften. Die Zusammensetzung der im Labor vorbereiteten Gußblöcke ist in der *Tabelle 1* dargestellt. Dabei sollte beachtet werden, dass die Verhältnisse in den Zusammensetzungen im Gusszustand (as-cast) etwas höher lagen als entworfen, bzw. 1,44 und 2,39 je in den bor- und hochborhaltigen Legierungen. Freies Bor könnte daher auch in der Borlegierung vorhanden sein.

Die Gußblöcke wurden auf einer manuell beschickten Walzstraße warmgewalzt mit einer Erwärmung bei 1176°C und einer in drei Stufen auf zwei Warmwalzstraßen durchgeführten Reduzierung. Anfangs wurden die Vierkantstäbe von 12,7 auf 9,5cm mit abgerundeten Ecken (RCS - *Round Corner Square*) reduziert, gefolgt von der Luftkühlung zur Raumtemperatur, Erwärmung und Walzen auf 4,76cm.

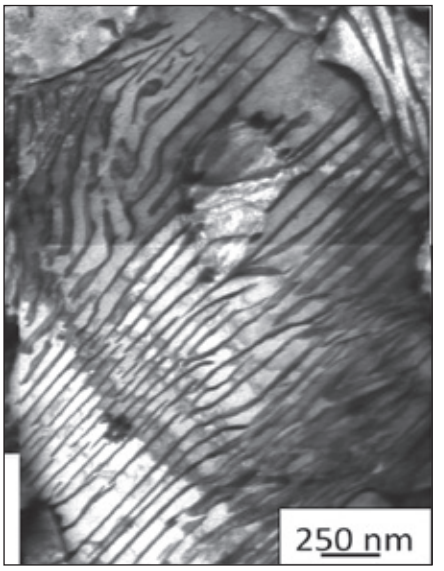
Das Material wurde dann mit Maschinen bearbeitet um Oxide zu entfernen und in 6-7 Blöcke geschnitten. Die letzte Reduzierung wurde auf einer zweiten Warmwalzstraße durchgeführt bis zu einer Endgröße von 7,1mm. Das Material wurde nach dem Warmwalzen bis zur Umgebungsluft gekühlt.

Danach wurde das Material, vor dem Ziehen, mit einer Säge auf Längen von 3,7m geschnitten. Je Legierung wurden vierundzwanzig Abschnitte erzielt. Obwohl die Thermo-Calc® thermodynamischen Berechnungen ein Potential an Heißrissanfälligkeit im hochborhaltigem Stahl vorhersagten, wurden keinerlei Brüche noch wesentliche Oberflächenmängel beobachtet. Während eine wesentliche Entkohlung bemerkt wurde, [8] wurde das Material auf 5,5mm Durchmesser spitzenlos geschliffen.

Die warmgewalzten Stäbe wurden dann für die Kohlenstoff-Segregation bewertet und nur Stäbe mit einem Kohlenstoffgehalt von 0,78 ± 0.01 Gewicht-% wurden für das weitere Drahtziehen ausgewählt.

Das Drahtziehen wurde im technologischen Forschungszentrum von Bekaert durchgeführt und umfasste eine Reduzierung von 2,5mm Durchmesser in acht Ziehschritten. Die Patentierung erfolgte dann in Salzbädern mit einer Erwärmung auf 980°C gefolgt von 520°C. Der patentierte Draht wurden dann weiterhin auf 1mm gezogen.

Die Zugprüfung wurde an einer elektro-mechanischen Zugmaschine bei einer konstanten Dehnungsgeschwindigkeit von 5,6 10^{-4} /s, mit einem 5cm Dehnungsmesser bei 50% durchgeführt. Zwei Muster wurden je Bedingung geprüft. Gleichmäßige Dehnungen wurden als technische Dehnung bei der Spitzenlast, die für Zerreißfestigkeit *(UTS - Ultimate Tensile Strength)*-Berechnungen benutzt wurde, bestimmt und die gesamten Dehnungen bis zum Ausfall wurden von den Angaben des Dehnungsmessers beim Endbruch erreicht.



▲ **Bild 2**: *Elektronenmikrograph-Übermittlung des warmgewalzten und luftgekühlten hochborhaltigen Materials*

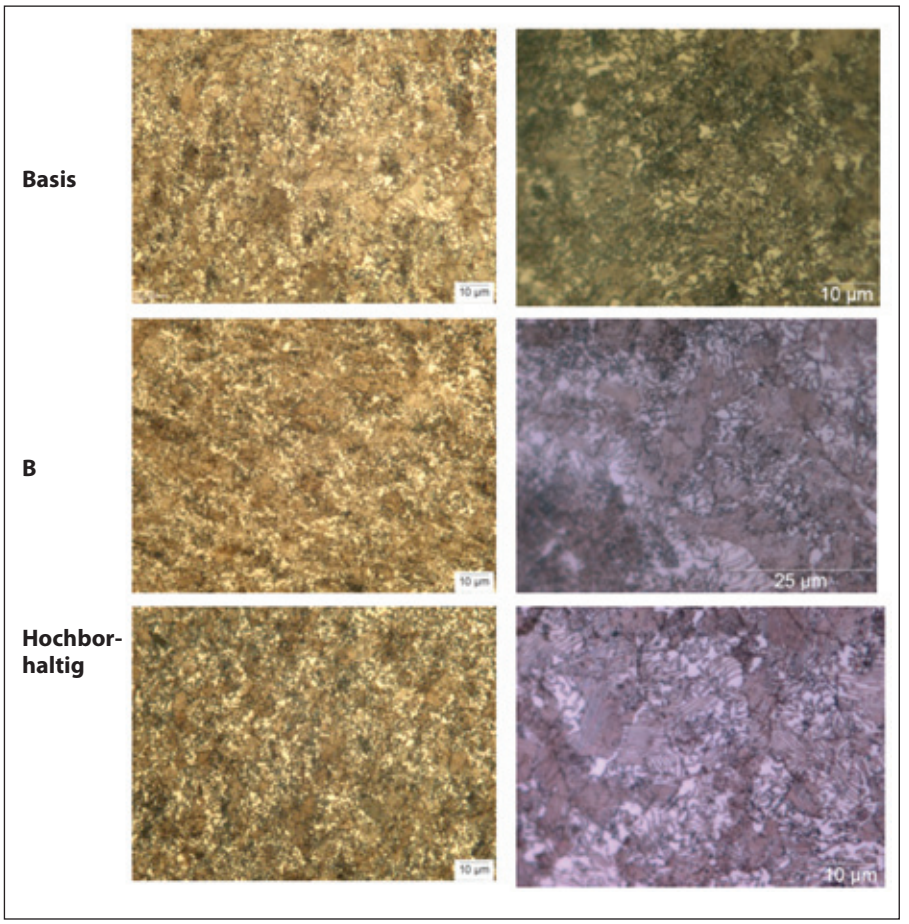
Es wurde beobachtet, dass alle Muster innerhalb der spezifizierten Länge des Dehnungsmessgeräts versagten, wenn nicht anders angegeben.

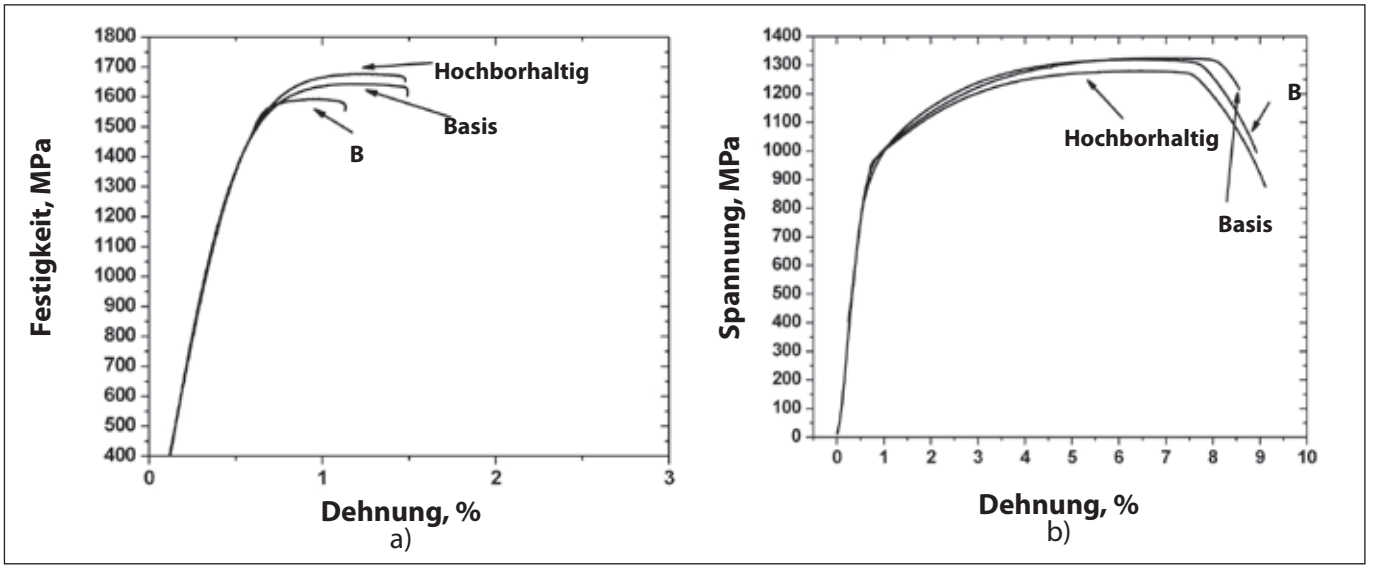
Die mikrostrukturelle Charakterisier- ung erfolgte über eine lichtoptische Mikroskopie geätzt mit 4% Pikral Muster und durch Transmissionselektronenmikroskopie (TEM) an einem Philips CM120 120kV-Gerät. Dünne Folien wurden mit einem Doppelstrahl-Schleifer Fischione elektropoliert, der bei 32V und bei Raumtemperatur arbeitet, mit Einsatz eines Gemischs von 95% Essig- und 5% Perchlorsäure.

Dilatometrie wurde auf einem Gleeble® 1500-System durchgeführt. Muster wurden bei 950°C bei einer konstanten Aufheizgeschwindigkeit von 20°C/s erwärmt und isothermisch fünf Minuten lang gehalten. Der Stahl wurde dann im Heliumgas bei programmierten konstanten Kühlgeschwindigkeiten von je 50, 30, 25, 12,5, 10, 7,5, 5, 2,5 und 1°C/s gekühlt.

Aufeinander folgende Prüfungen wurden auf eine einzelne Probe je Legierung durchgeführt. Die Dilation der Muster wurde in Bezug auf Temperatur und Zeit überwacht.

▼ **Bild 1**: *Lichtoptische Mikrofotografien der warmgewalzten Stäbe aus Basis-, B- und hochborhaltige Stählen. Muster quer gegenüber der Walzrichtung entnommen, in der Mitte des Querschnitts, geätzt mit 4% Pikral*





▲ **Bild 5**: *Spannungs-Dehnungskurven des Drahts a) gezogen auf 2,5mm und b) patentiert bei 2,5mm*

		UTS, MPa	UE, %	TE, %
Gezogen bis zu 2,5mm	Basis	1644	1.2	1.5
	B	1592	1.0	1.1
	Hochborhaltig	1677	1.2	1.5
Patentiert bei 2,5mm	Basis	1324	7.3	8.6
	B	1317	6.7	8.9
	Hochborhaltig	1277	6.7	9.1

▲ **Tabelle 3** – *Zugeigenschaften Zerreißfestigkeit (UTS), gleichmäßige Dehnung (UE), und gesamte Dehnung (TE) der Drähte gezogen auf 2,5mm und patentiert auf 2,5mm*

Der hochborhaltige Stahl zeigt niedrigere Zerreißfestigkeitswerte; eine gleichmäßige Deformation wird bei niedrigeren Festigkeiten beobachtet im Vergleich zu den anderen Stählen und ein um etwa 25 MPa niedrigerer Wert der Zerreißfestigkeit wurde erreicht.

Der Festigkeitsunterschied kann nicht dem Kohlenstoff zugeschrieben werden, da Muster mit demselben Kohlenstoffgehalt für die Prüfung ausgewählt wurden. Der hochborhaltige Stahl zeigte eine höhere Zugdehnung.

Es ist wichtig hervorzuheben, dass eine reduzierte Zugfestigkeit mit Borlegierung mit einer zuvor durchgeführten Studie über niedriggekohlte[1] und hochgekohlte[7] Stähle übereinstimmt sowie mit einer erhöhten Härtung, die in der Dilatometriestudie beobachtet wurde. Erhöhte Perlitumwandlungskinetik könnte zu einem erhöhten Lamellenabstand und/oder groberen Perlit führen.

Man könnte argumentieren, dass das reduzierte Festigkeitsniveau mit einer reduzierten Mischkristallverfestigung verbunden sein könnte. Es müsste jedoch genauso erkannt werden, dass die B-Legierung keine Festigkeitsreduzierung im Vergleich zur Basislegierung zeigt.

Es wurde zuvor darauf hingewiesen, dass sich die Festigkeitsreduzierung auf eine Legierungswirkung bezieht hinsichtlich der austenitischen zur ferritischen[1] oder perlitischen[10] Umwandlung.

Die mechanischen Eigenschaften nach dem Drahtziehen bis zu 2,5mm Durchmesser sind im *Bild 5a* und in der *Tabelle 3* dargestellt.

In der gezogenen Bedingung, zeigt der B-Stahl die niedrigste Zugfestigkeit und Dehnung, der hochborhaltige Stahl zeigt die höchste Zugfestigkeit und eine höhere Dehnung im Vergleich zum B-Stahl.

Der Basisstahl zeigt eine ähnlich gleichmäßige und gesamte Dehnung im Vergleich zum hochborhaltigen Stahl, wenn auch bei einer niedrigeren Zugfestigkeit. Es sollte erkannt werden, dass Ausfälle bei den Zuggriffen eintreten, die wahrscheinlich die gesamten Dehnungswerte beeinflusst haben.

Die erzielten Zugeigenschaften nach der Patentierung bei 2,5mm Durchmesser sind im *Bild 5b* und in der *Tabelle 3* dargestellt.

Ähnliche Zugfestigkeiten werden im Basis- und B-Stahl erzielt, während der hochborhaltige Stahl eine um zirka 50 MPa niedrige Zerreißfestigkeit zeigt.

Dieser niedrigere Festigkeitswert könnte sich wieder auf die erhöhte Zersetzungskinetik des Austenits beziehen. Eine etwas höhere Gesamtdehnung wird für beide borhaltige Stähle erzielt.

Die patentierten Drähte wurden nachträglich auf 1mm Durchmesser in aufeinanderfolgenden Stichen gezogen und die sich ergebenden Zugeigenschaften, neben der Anzahl an Verdrehungen bis zum Ausfall (N_t) und der Anzahl an gewendeten Biegungen (N_b), sind in der *Tabelle 4* dargestellt.

Eine Senkung der Zugfestigkeit mit Borlegierung ist erneut offensichtlich zusammen mit einer geringen Erhöhung bei der gleichmäßigen und gesamten Dehnung.

Die Anzahl an Verdrehungen bis zum Ausfall wird jedoch nicht durch die Legierung geändert, während eine geringe Senkung der Anzahl an gewendeten Biegungen mit erhöhten Borniveaus beobachtet wird. Um die Alterungsantwort des 1mm gezogenen Drahts zu bewerten, wurde eine isothermische Alterung bei 150°C eine Stunde lang durchgeführt.

▼ **Tabelle 4** – *Zugeigenschaften Zerreißfestigkeit (UTS), gleichmäßige Dehnung (UE), und gesamte Dehnung (TE) der Drähte gezogen auf 1mm nach der Patentierung*

	UTS, MPa	UE, %	TE, %	Nt	Nb
Basis	2106	1.1	2.1	41	12
B	2096	1.3	2.4	42	11
Hochborhaltig	2087	1.4	2.5	41	9

	UTS, MPa	UE, %	TE, %	Nt	Nb
Basis	2263	0.4	1.5	35	11
B	2283	0.4	1.5	36	10
Hochborhaltig	2257	0.4	1.5	36	8

▲ **Tabelle 5** – *Zugeigenschaften Zerreißfestigkeit (UTS), gleichmäßige Dehnung (UE), und gesamte Dehnung (TE) nach einer Stunde Alterung bei 150 ºC der Drähte, die auf 1mm nach der Patentierung gezogen werden*

Die entsprechenden Ergebnisse sind in der *Tabelle 5* dargestellt. Erzielt wurde eine Erhöhung der Zugfestigkeit um zirka 170MPa, während die gleichmäßigen Zugdehnungen bis auf 0,4% und die gesamte Dehnung bis auf 1,5% gesenkt wurden.

Ähnliche Dehnungen wurden in allen Legierungen erzielt. Erneut wurden in allen Legierungen ähnliche Verdrehungen bis zum Ausfall beobachtet, jedoch bei niedrigerem Niveau was das nicht gealterte Material betrifft.

Der Trend reduzierte gewendete Biegungen mit erhöhten Bor-Niveaus zu erreichen wurde erneut im gealterten Zustand beobachtet und im gealterten Zustand wird gegenüber dem nicht gealterten Zustand für alle Stähle zirka eine Biegung weniger erzielt.

Dies lässt darauf schließen, dass die Borlegierung keine wesentliche Wirkung auf die Duktilität bei den erforschten Stickstoffniveaus aufweist.

Es sollte bemerkt werden, dass die Stickstoffniveaus der vorliegenden Schmelzen von zirka 40ppm das industriell gefertigte Material mit niedrigsten Qualitätsmerkmalen darstellt.

Schlussfolgerungen

Erforscht wurde die Wirkung der Borlegierung von 0,80C Stählen um "freies" Zwischengitter-Stickstoff zu binden.

Schmelzen mit einem B/N-Verhältnis von 1,4 und 2,4 neben einer Basislegierung ohne Bor wurde im Labor vorbereitet, warmgewalzt, gezogen, patentiert und weiterhin auf ein Enddurchmesser von 1mm gezogen.

Die mikrostrukturelle Charakterisierung wurde durchgeführt und die Zugeigenschaften bewertet.

Eine beschränkte Wirkung der Borlegierung war bei den erforschten Stickstoffniveaus der Drahteigenschaften, insbesondere der Torsionsduktilität, offensichtlich.

Eine reduzierte Zerreißfestigkeit wurde im hochborhaltigen Stahl beobachtet. ■

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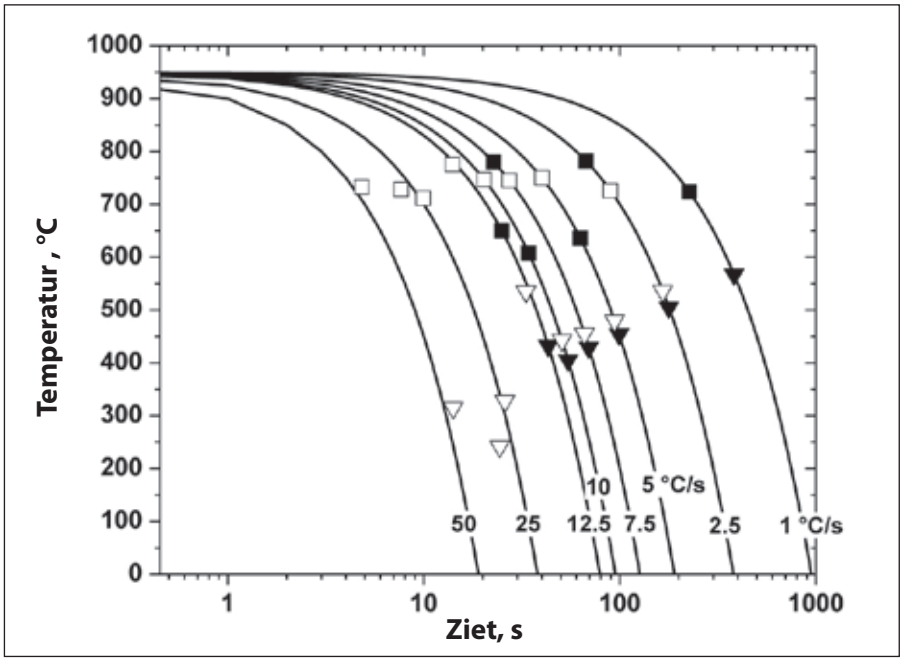


▲ **Bild 3**: Start- (Vierecke) und End- (Dreiecke) Temperaturen der Umwandlung für unterschiedliche konstante Kühlgeschwindigkeiten. Gefüllte Symbole: Basislegierung und offene Symbole: B-Stahl

Ergebnisse und Diskussion

Lichtoptische Mikrofotografien, die in der Mitte des Querschnitts der warmgewalzten Stäbe aufgenommen wurden, sind in der *Bild 1* angegeben, bzw.

Perlitische Mikrostrukturen sind offensichtlich. Netzwerke aus pro-eutektoiden Bestandteilen wurde nicht beobachtet. TEM wurde auf dem superstöchiometrisch legiertem Stahl durchgeführt, um die Wirkung des freien Bor auf die mikrostrukturelle Entwicklung zu bewerten und eine repräsentative TEM-Mikrofotografie ist im *Bild 2* dargestellt. Martensit wurde nicht erfasst, das könnte vielleicht darauf hinweisen, dass das freie Bor nicht bezüglich der Härtung zugenommen hat. Bor ist für die starke Zunahme der Härtung in niedriggekohlten Stählen bekannt.[9]

Diese Wirkung hat sich jedoch bei hochgekohlten Stählen als weniger ausgeprägt erwiesen.[10,11] Um die Legierungswirkung auf die Härtung zu bewerten, wurde die Dilatometrie auf die Basis- und B-Legierung, wie im Bezug 12 erwähnt, durchgeführt. Es zeigte sich, dass die Borlegierung, wie im *Bild 3* dargestellt, eine verringerte Härtung ergab, wo die Start- und Endtemperaturen der Umwandlung für die Basis- und B-Legierung bei einer Temperatur abhängig vom Zeitplan dargestellt sind. Verschiedene konstante Kühlgeschwindigkeiten wurden wie angegeben untersucht. Bei Kühlgeschwindigkeiten von 25 und 50°C/s, war die Martensitumwandlung der einzige in der Basislegierung erfasste Zersetzungsmechanismus des Austenits, während die Perlitumwandlung im B-Stahl beobachtet wurde. Darüber hinaus zeigt der B-Stahl einen größeren Perlitumwandlungsbereich auf.

Spannungs-Dehnungskurven und Zugeigenschaften der warmgewalzten Stäbe sind im *Bild 4* und in der *Tabelle 2* dargestellt.

Basis- und B-Stähle zeigen sehr ähnliche Spannungs-Dehnungsverhalten, obwohl der B-Stahl eine Dehnung bei Streckspannung (YPE - *Yield Point Elongation*) vorzeigt, während der Basisstahl eine kontinuierliche (bzw. gleichmäßige, *round-house*) plastische Deformation aufweist.

Das Auftreten von YPE könnte etwas unerwartet sein, da die Legierung entworfen wurde damit das Bor am Stickstoff verbunden bleibt und daher die YPE nicht von der "freien" Stickstoff-Deformationsalterung bestimmt werden sollten. Das Verhalten bezieht sich daher wahrscheinlich auf die Kohlenstoff-Deformationsalterung.

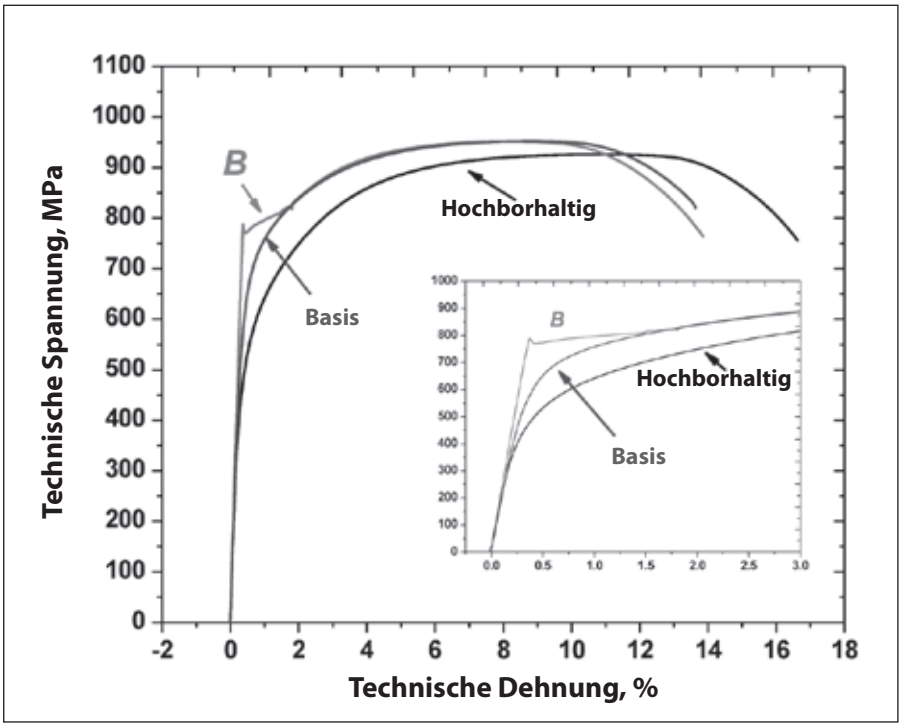
Es sollte anerkannt werden, dass Stäbe bei Umgebungstemperatur, nach dem Warmwalzen, gezogen wurden, und dass die ungleichmäßige Dehnung während des Ziehens in einigen Fällen zur Beseitigung der YPE geführt haben könnte.

Ähnliche Zugfestigkeiten und Dehnungen wurden im Basis- und im B-Stahl erzielt.

▼ **Tabelle 2** – *Zugeigenschaften der warmgewalzten Stäbe*

	UTS, MPa	UE, %	TE, %
Basis	952	9.4	13.7
B	951	8.2	13.9
Hochborhaltig	926	11.2	16.6

▼ **Bild 4**: Spannungs-Dehnungskurven der warmgewalzten Stäbe



«Детвилер» прокладывает кабельные магистрали в новом информационном центре для регионального объединения Рейнланд

С целью оптимизации своей деятельности системный интегратор регионального объединения Рейнланд (ЛФР) «ЛФР-ИнфоКом» (LVR-InfoKom) увеличил мощности основного центра сбора и обработки данных в г. Кельне (Германия) и перевел его в новое здание. Контракт на прокладку новых кабельных линий был заключен с компанией «Детвилер» (Datwyler), которая предложила комплексное экономичное решение и сжатые сроки выполнения работ.

▲ *Новый центр сбора и обработки данных, построенный с участием компании «Детвилер»*

В 2009 году «ЛФР-ИнфоКом» принял решение об увеличении мощности одного из двух принадлежавших ему центров сбора и обработки данных и о его переводе в новое здание, в котором, помимо серверной комнаты, также размещен ряд функциональных помещений.

В новом информационном центре необходимо было провести разводку межсоединений всех активных узлов с использованием перспективной стоечной кабельной системы верхнего уровня.

В этой связи в секторе производства медных кабелей был проведен тендер на поставку кабельной системы класса EA с пропускной способностью 10 гигабит. У производителей волоконно-оптических кабелей (ВОК) объединение ЛФР запросило многомодовые кабели OM3, а для внешних линий связи – одномодовые кабели в виде оптоволоконных модулей с защитной оболочкой, которые должны были поставляться в комплекте с кабельными разделителями и модульными LCD разъемами.

В дополнение к проведению мероприятий по приемке продукции и функциональной диагностике кабельных соединений требовалось предоставить 20-летнюю гарантию на систему, а также полный комплект документации, в том числе схему соединения активных компонентов.

Проект расширения кабельной сети должен был предусматривать прокладку кабеля, строительство инженерных систем противопожарной защиты между помещениями и обустройство кабельных трасс в коридорах.

Dätwyler (Германия)
Web-страница: www.datwyler.com

Капиталовложения в модернизацию производства

Компания «Хатчинсон инжиниринг» (Hutchinson Engineering) из г. Виднес (гр. Чешир, Великобритания) намерена инвестировать более 500 тыс. фунтов стерлингов в новое оборудование для оптимизации своей деятельности, связанной с изготовлением вышек сотовой связи и конструктивных элементов для ветровых турбин.

Новое оборудование производства компании «Фисеп» (Ficep), включающее в себя установку серии Gemini стоимостью 370 тыс. фунтов стерлингов от итальянского производителя, предназначенную для сверления, нарезки резьбы, фрезерования, разметки и термической резки металлических изделий, и профилирующий станок PC-600 для обработки трубных изделий стоимостью 140 тыс. фунтов стерлингов от голландского поставщика, должно ускорить процессы изготовления и резки за счет выпуска высококачественных деталей, обеспечивающих более точную посадку по месту и меньшее время сварки.

Hutchinson Engineering (Великобритания)
Web-страница: www.hutchinson-engineering.co.uk

«Розендал» удовлетворяет спрос

Волоконно-оптические кабели с гидрофобным заполнением по-прежнему составляют значительную часть рынка ВОК. Выпускаемые компанией «Розендал» (Rosendahl) экструзионные головки серии RX отвечают требованиям рынка за счет использования дополнительно поставляемой модульной системы нагнетания геля с легко заменяемыми и регулируемыми игольчатыми клапанами, которая монтируется на высокоточных линейных направляющих.

Постоянное нагнетание тиксотропного геля и полностью сбалансированный расход полимера в распределителях экструзионных головок серии RX гарантируют непрерывность и стабильность формирования компаунда для волоконно-оптических кабелей в зоне выпуска.

Экструзионные головки серии RX производства компании «Розендал» в целом обеспечивают высокую степень центричности, не допуская, таким образом, превышения номинальной величины толщины кабельной изоляции и позволяя снизить материальные и производственные затраты. Улучшенные геометрические параметры канала для потока материала соответствуют реологическим свойствам специальных оболочечных материалов, обеспечивают кратковременное нахождение полимерного расплава в агрегате и позволяют быстро и просто менять окраску материала. Компактная модульная конструкция и возможность удобного прецизионного центрирования

▼ *Заполнение гелем с помощью экструзионной головки серии RX*

также гарантированно обеспечивают удобство в обращении.

Конструкция предлагаемых компанией «Розендал» экструзионных головок серии RX исключает возникновение технологических отклонений и способствует повышению качественных показателей и производительности экструзионных линий при производстве волоконно-оптических кабелей с гидрофобным заполнением в виде геля.

Rosendahl (Австрия)
Web-страница: www.rosendahlaustria.com

Технология чтения ДНК: победа над ворами?

Принципиально новая портативная система тревожной сигнализации, которая может производить на удаленных объектах съемку похитителей с привязкой к совершенным преступлениям, используя технологию чтения ДНК, признана полицией крупным шагом в борьбе с массовым ростом краж металлов.

Комплекс технологических решений с сигнализацией о несанкционированном проникновении и возможностью оперативного контроля (Alarmed and Traceable Technology Solutions System, или AATTS), разработанный компанией «Пи-ай-ди системз» (PID Systems) из г. Килмарнок (Шотландия), является первой специализированной, предназначенной для охраны слабозащищенных имущественных объектов и участков местности системой охранной сигнализации, которая будет одобрена и рекомендована для использования Ассоциацией руководителей полицейских служб (ACPO).

Система использует беспроводные технологии и поэтому не требует подключения к сетевому источнику электропитания. Установка системы выполняется быстро и просто. При обнаружении попытки несанкционированного доступа система, помимо звукового оповещения, передает сигнал владельцу здания и в компанию «Пи-ай-ди системз», а также снимает попытку кражи на видео.

Система, выполненная в вандалоустойчивом корпусе, используется совместно с несмываемой красной краской, которая светится в ультрафиолетовом (УФ) излучении и видна только в УФ свете. Она помечает злоумышленников уникальным, состоящим из кодированных молекул маркерным веществом, с помощью которого можно проследить путь до места преступления.

В последнее время наблюдается массовый рост связанных с хищением металлов преступлений, вызванный скачком мировых цен. Цена меди возросла с 889 фунтов стерлингов за тонну по состоянию на ноябрь 2001 года до своего максимума в 6356 фунтов стерлингов за тонну, который был зафиксирован в прошлом году.

По данным Управления Ее Величества по налогам и таможенным сборам, приблизительно 10 тысяч случаев краж металлов ежегодно обходятся экономике Великобритании более чем в 5,6 млрд. фунтов стерлингов в виде упущенной выгоды.

Среди тех, кто в наибольшей степени пострадал от краж меди, – компании «Нетуорк рейл» (Network Rail), столкнувшаяся с ростом числа краж железнодорожного кабеля в период с 2009 по 2010 гг. на 65 процентов, что привело к потере 16 тыс. часов рабочего времени, и «Би-ти» (BT), в которой рост числа краж кабеля в прошлом году составил 12 процентов.

PID Systems (Великобритания)
Web-страница: www.pid-systems.co.uk

Влияние легирования бором на эволюцию микроструктуры и физико-механические свойства высокоуглеродистой проволоки

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Аннотация

Легирование бором часто производится в низкоуглеродистых сталях для связывания свободного азота и предотвращения деформационного старения. В результате повышается пластичность (при кручении) проволочных изделий. Настоящая работа исследует влияние легирования бором на свойства высокоуглеродистых сталей (с содержанием углерода 0,80 % по массе). Наряду с эталонной плавкой проведены лабораторные плавки с использованием шихты, в которой величины массового отношения бора к азоту составляли 1:1 и 2:1. Заготовки были подвергнуты горячей прокатке, волочению, патентированию, а также дополнительному волочению с уменьшением диаметра до 1 мм. На каждом промежуточном этапе проводилась оценка физико-механических свойств, а также исследовались характеристики микроструктуры. На уровне физико-механических свойств ограниченное влияние легирования бором очевидно.

Введение

Сталеплавильное производство в электродуговых печах ведется во все больших масштабах, в особенности в Северной Америке, для получения стали, используемой при изготовления длинномерного сортового проката. Замена технологии производства кипящей стали на непрерывную разливку электростали усложняет задачу выполнения требований к качеству продукции, в частности по обеспечению пластичности (при кручении). Это связано с характерным для электростали повышенным содержанием азота. Мобильность соединений азота может привести к деформационному старению и, как следствие, к повышению упругих свойств (наклепу) и понижению пластических свойств проволочной продукции.[1] Проблеме снижения содержания свободного азота в катанке из низкоуглеродистых марок стали посредством легирования микродобавками, например, бора, ванадия или ниобия (с концентрацией порядка $1x10^{-6}$) посвящены серьезные исследования. Вопросы легирования бором высокоуглеродистых сталей изучены не столь широко[2], и данная тема стала предметом настоящего исследования.

	C	Mn	Si	Cr	B, частей на миллион	N, частей на миллион
Базисная сталь	0.78	0.48	0.25	0.20	–	42
Сталь, легированная бором	0.82	0.46	0.23	0.20	62	43
Высоколегированная сталь с высоким содержанием бора	0.76	0.47	0.23	0.20	98	41

▲ **Таблица 1.** *Химический состав стали, отлитой в лабораторных условиях (% по массе)*

Методика эксперимента

Бор может вступать в соединение с азотом, образуя при этом нитрид бора, в ходе реакции, имеющей следующий вид:

$$B + N = BN \quad (1)$$

При этом стехиометрический состав с учетом атомной массы бора и азота соответствует отношению бора к азоту, равному 11:14, или 0,79. В рамках настоящего исследования разработаны три сплава с содержанием углерода 0,80 % по массе, из которых один был взят за эталонный сплав, другой сплав содержал бор и азот в стехиометрическом соотношении, а третий представлял собой суперстехиометрический сплав с массовым отношением бора к азоту, равным 2:1. Последняя марка стали позволяет изучить влияние дополнительного количества «свободного» бора на развитие микроструктуры и свойства материала. Химический состав слитков, отлитых в лабораторных условиях, представлен в таблице 1. При этом необходимо отметить, что массовое отношение элементов в химическом составе стали непосредственно после отливки было несколько выше расчетных значений – 1,44 и 2,39 в сплаве, легированном бором, и в высоколегированном сплаве с высоким содержанием бора соответственно. Следовательно, бор в свободном состоянии может также присутствовать в составе сплава, легированного бором.

Слитки подвергались горячей прокатке на прокатном стане с ручной подачей с повторным нагревом до 1176 °C и с

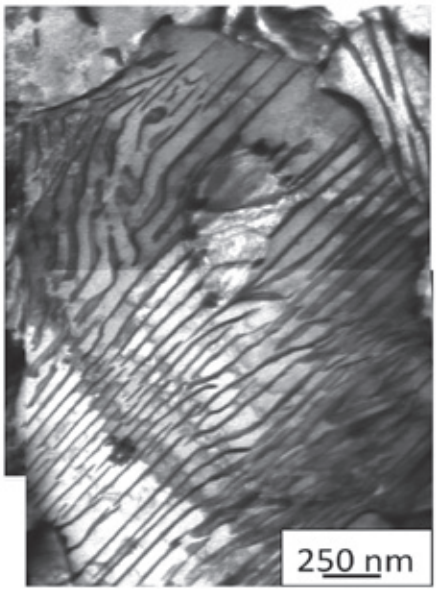
обжатием в три прохода на двух станах горячей прокатки. Сначала проводилось обжатие прутков из квадратного профиля с закругленными углами (RCS) со стороной 12,7 см в квадратный профиль с закругленными углами со стороной 9,5 см, после чего они охлаждались на воздухе до комнатной температуры, повторно нагревались и прокатывались до 4,76 см. Затем прутки механически обрабатывались для удаления окислов и резались на 6-7 блоков. На втором стане горячей прокатки производилось завершающее обжатие до конечного размера заготовок, равного 7,1 мм. После горячей прокатки прутки охлаждались окружающим воздухом. Затем перед волочением прутки на отрезном станке были разрезаны на мерные длины по 3,7 м. Для каждого сплава были получены двадцать четыре секции. Несмотря на то что возможность красноломкости высоколегированной стали с высоким содержанием бора была спрогнозирована на основе термодинамических расчетов с помощью ПО Thermo-Calc®, разрывов или существенных поверхностных дефектов зафиксировано не было. Ввиду того, что наблюдалось образование значительного обезуглероженного слоя,[3] заготовки были обработаны бесцентровым шлифованием до диаметра 5,5 мм. После этого была проведена оценка качества горячекатаной катанки для определения количества выделенного углерода, и для последующей операции волочения проволоки были отобраны только те заготовки катанки, в которых содержание углерода составляло 0,78 ± 0,01 % по массе.

Волочение проволоки выполнялось в Технологическим центре компании «Бекерт» и состояло в уменьшении диаметра заготовок до 2,5 мм за восемь проходов. После этого проводилось патентирование в соляных ваннах с нагревом и выдержкой при 980 °C, а затем при 520 °C. Далее патентированная проволока дополнительно протягивалась до диаметра, равного 1 мм.

Определение прочности при растяжении проводилось на электромеханической разрывной машине при постоянной скорости деформации 5,6 10^{-4} /с с помощью экстензометра (измерительная база – 5 см, относительная деформация – 50 %). Для каждого состояния испытывалось по два образца. Однородная деформация определялась как условная деформация при пиковой нагрузке, которая использовалась для расчетов предельной прочности на разрыв (UTS), а значения суммарной деформации при растяжении были получены по результатам измерений экстензометром при полном разрыве. Разрыв на всех образцах наблюдался в пределах указанной измерительной базы экстензометра, за исключением специально оговоренных случаев.

Характеристики микроструктуры изучались методом светооптической микроскопии на образцах с поверхностью, протравленной 4-процентным раствором пикриновой кислоты, и методом просвечивающей электронной микроскопии (ПЭМ) с использованием микроскопа Philips CM120 с ускоряющим напряжением 120 кВ. Тонкие фольги подвергались электролитическому полированию при комнатной температуре с помощью двухструйного полировального устройства Fischione при рабочем напряжении 32 В и с использованием смеси из уксусной (95 %) и перхлорной (5 %) кислот.

Дилатометрическое исследование проводилось с помощью системы Gleeble® 1500. Образцы повторно нагревались до 950 °C при постоянной скорости нагрева, составляющей 20 °C/с, и выдерживались в изотермических условиях в течение пяти минут. После этого сталь охлаждалась гелием с программно установленными скоростями охлаждения, равными 50, 30, 25, 12,5, 10, 7,5, 5, 2,5 и 1 °C/с соответственно. Последовательные испытания проводились на одном образце для каждого сплава. Растяжение образцов контролировалось с учетом температуры и времени.

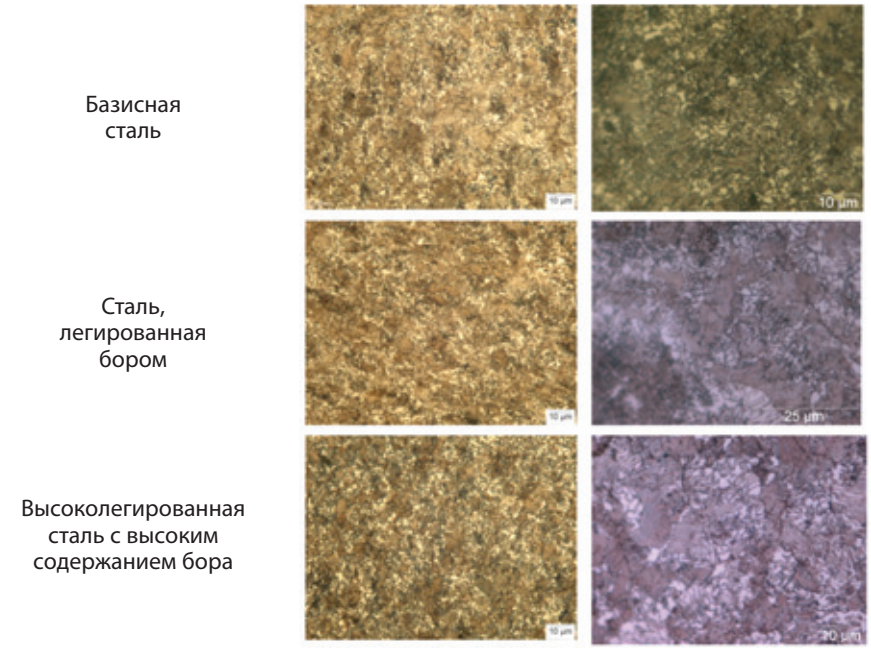


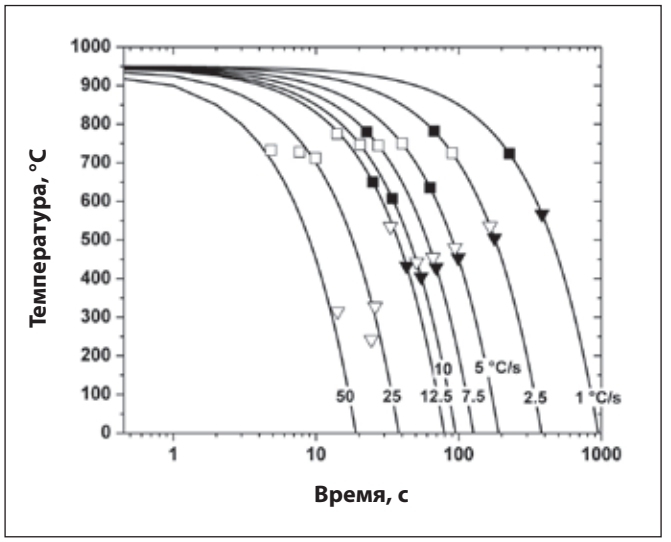
▲ **Рис. 2.** *Микроснимок шлифа горячекатаной, охлажденной на воздухе высоколегированной стали с высоким содержанием бора, полученный методом ПЭМ*

Результаты и их обсуждение

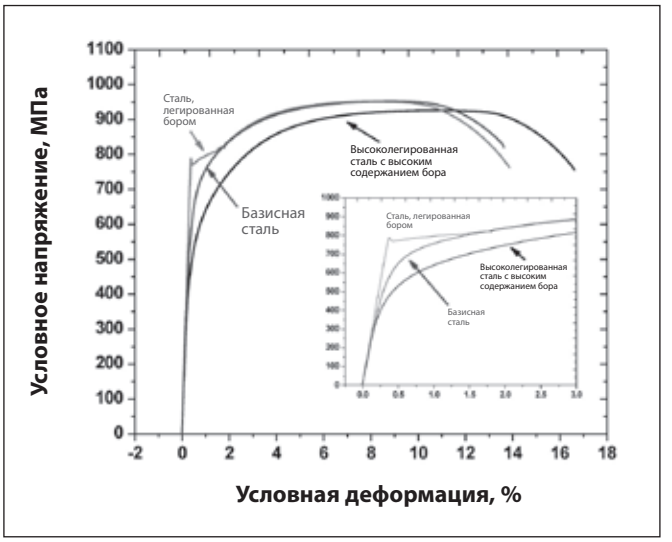
Микроснимки, полученные с помощью светооптического микроскопа в средней части микрошлифов образцов горячекатаной катанки, представлены на рис. 1. Очевидно наличие перлита в микроструктуре стали. Наличие сеток доэвтектоидных составляющих выявлено не было. Исследование

▼ **Рис. 1.** *Микроснимки горячекатаной катанки, полученные с помощью светооптического микроскопа на образцах из базисной стали, стали, легированной бором, и высоколегированной стали с высоким содержанием бора. Образцы взяты в поперечной направлению прокатки плоскости, микроснимки получены в средней части микрошлифов, поверхность протравлена 4-процентным раствором пикриновой кислоты*





▲ **Рис. 3.** *Температура начала (квадратные метки) и окончания (треугольные метки) структурного превращения при различных значениях постоянной скорости охлаждения. Закрашенные метки – базисный сплав, незакрашенные метки – сталь, легированная бором*



▲ **Рис. 4.** *Кривые зависимости деформации горячекатаной катанки от напряжения*

методом ПЭМ проводилось на образцах стали, легированной суперстехиометрическим составом, для оценки влияния свободного бора на эволюцию микроструктуры. Характерный микроснимок, полученный методом ПЭМ, представлен на рис. 2. Мартенсит не был выявлен, что, вероятно, предполагает, что свободный бор не привел к увеличению прокаливаемости. Известно, что бор существенно увеличивает прокаливаемость низкоуглеродистых сталей.[4] Однако, согласно имеющимся сообщениям, это влияние не столь выражено в высокоуглеродистых сталях.[5,6] Для определения степени влияния, которое легирование оказывает на прокаливаемость, проведено дилатометрическое исследование с использованием базисного сплава и сплава, легированного бором, в соответствии с методикой, рассматриваемой в работе [7]. Продемонстрировано, что легирование бором ведет к снижению прокаливаемости, как показано на рис. 3, на котором данные изменения температуры начала и окончания структурного превращения для базисного сплава и сплава, легированного бором, представлены в виде графика зависимости от времени. Показаны используемые в исследовании различные постоянные скорости охлаждения. При скорости охлаждения 25 и 50 °C/c единственным механизмом разложения аустенита, выявленным в базисном сплаве, было мартенситное превращение, тогда как в стали, легированной бором, наблюдалось перлитное превращение. Кроме того, сталь, легированная бором, характеризовалась более обширной областью перлитного превращения.

Кривые зависимости деформации горячекатаной катанки от напряжения и данные по ее механическим свойствам при растяжении представлены на рис. 4 и в таблице 2. Базисная сталь и сталь, легированная бором, характеризуются очень похожим напряженно-деформированным состоянием, хотя сталь, легированная бором, демонстрирует удлинение, соответствующее пределу текучести (YPE), тогда как базисная сталь характеризуется пластической деформацией, носящей непрерывный характер (т. е. распределенной равномерно, «по кругу»). Возникновение удлинения, соответствующего пределу текучести, может быть несколько неожиданным, так как, согласно расчетам, содержащийся в сплаве азот должен быть связан с бором, и потому обусловленное наличием «свободного» азота деформационное старение не должно вести к возникновению удлинения, соответствующего пределу текучести. Таким образом, указанное состояние предположительно связано с деформационным старением, вызванным углеродом. При этом необходимо понимать, что правка катанки производилась при комнатной температуре с последующей горячей прокаткой, и возникающая в процессе правки неоднородная деформация могла в некоторых случаях привести к исчезновению удлинения, соответствующего пределу текучести. Аналогичные показатели прочности при растяжении и параметры удлинения были получены для базисной стали и стали, легированной бором.

Высоколегированная сталь с высоким содержанием бора продемонстрировала более низкие прочностные характеристики: равномерное распределение пластической деформации наблюдается при более низкой по сравнению с другими марками стали прочности, а зарегистрированный предел прочности при растяжении снизился приблизительно на 25 МПа. Указанная разница в прочностных характеристиках не может быть объяснена наличием углерода, поскольку его содержание в образцах, выбранных для испытаний, было одинаковым. Образцы из высоколегированной стали с высоким содержанием бора продемонстрировали более высокие значения относительного удлинения при растяжении. Интересно отметить, что снижение прочности на

▼ **Таблица 2.** *Механические свойства горячекатаной катанки при растяжении*

	Предел прочности на разрыв, МПа	Относительное равномерное удлинение, %	Общее удлинение, %
Базисная сталь	952	9.4	13.7
Сталь, легированная бором	951	8.2	13.9
Высоколегированная сталь с высоким содержанием бора	926	11.2	16.6

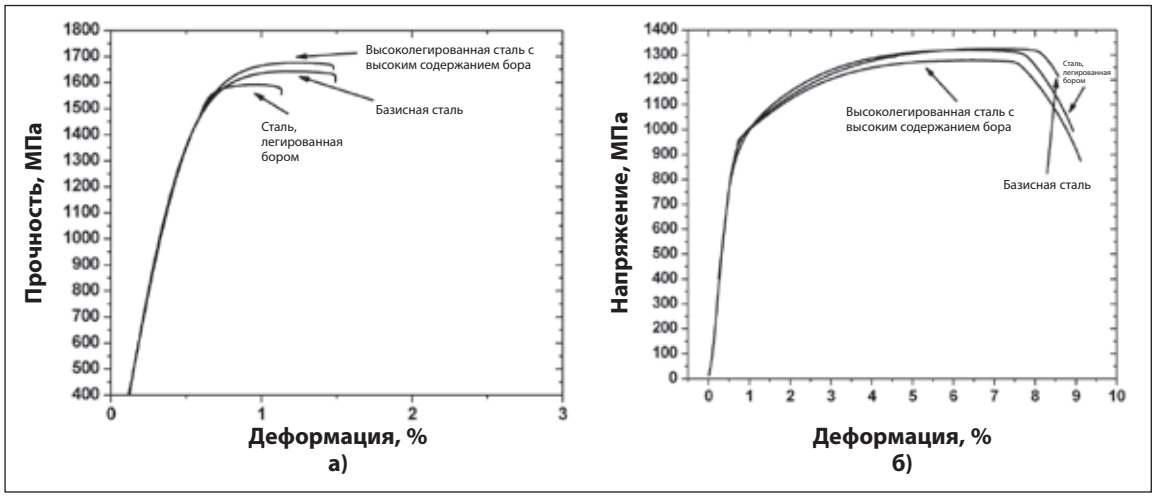


Рис. 5. *Кривые зависимости деформации от напряжения проволоки а) после волочения с уменьшением диаметра до 2,5 мм и б) после патентирования образцов диаметром 2,5 мм*

растяжение при легировании бором совпадает с данными предыдущих исследований низкоуглеродистых[1] и высокоуглеродистых[7] сталей, а также согласуется с увеличением прокаливаемости, которое наблюдалось в ходе дилатометрического исследования. Рост кинетики перлитного превращения может привести к увеличению межпластинчатого расстояния и (или) укрупнению перлитных зерен. Допустимо было бы также утверждать, что снижение уровня прочности может быть связано с более низкой степенью упрочнения твердого раствора. Тем не менее, следует признать, что в отличие от базисного сплава сплав, легированный бором, не демонстрирует снижения прочностных характеристик. Ранее высказывалось предположение о том, что снижение прочности связано с влиянием легирования на превращение аустенита в феррит[1] или перлит[11].

Физико-механические свойства, полученные после волочения проволоки с уменьшением диаметра до 2,5 мм, представлены на рис. 5а и в таблице 3. В холоднотянутом состоянии сталь, легированная бором, имеет самые низкие показатели прочности при растяжении и относительного удлинения, а высоколегированная сталь с высоким содержанием бора обладает максимальной прочностью при растяжении и более высокими по сравнению со сталью, легированной бором, показателями относительного удлинения. Базисная сталь демонстрирует аналогичные высоколегированной стали с высоким содержанием бора показатели равномерного и общего удлинения, хотя и при более низкой прочности при растяжении. Следует признать, что в захватах машины для испытания на растяжение возникали обрывы, что, видимо, сказалось на значениях общего удлинения.

Механические свойства при растяжении, полученные после патентирования образцов диаметром 2,5 мм, представлены на рис. 5б и в таблице 3. Аналогичные показатели прочности при растяжении получены в образцах из базисной стали и из стали, легированной бором, тогда как высоколегированная сталь с высоким содержанием бора демонстрирует снижение предела прочности при растяжении примерно на 50 МПа. Более низкая величина прочности также может быть связана с ростом кинетики разложения аустенита. Несколько бóльшая величина общего удлинения получена для обеих марок борсодержащих сталей.

Далее образцы патентированной проволоки были протянуты в несколько последовательных переходов до диаметра 1 мм . Полученные в результате механические характеристики при растяжении, наряду с данными по количеству витков до обрыва (N_t) и количеству знакопеременных изгибов (N_b), представлены в таблице 4. Вновь очевидно снижение прочности на растяжение при легировании бором, равно как и некоторое увеличение значений равномерного и общего удлинения. Однако количество витков до обрыва вследствие легирования не меняется, хотя с увеличением содержания бора наблюдается незначительное сокращение числа знакопеременных изгибов. Для определения чувствительности тянутой проволоки диаметром 1 мм к старению были проведены испытания на изотермическое старение при температуре 150 °С в течение одного часа. Полученные результаты приведены в таблице 5. Выявлено увеличение прочности при растяжении примерно на 170 МПа, при этом параметры

Таблица 3. *Механические свойства при растяжении: предел прочности на разрыв (UTS), относительное равномерное удлинение (UE) и общее удлинение (TE) проволоки после волочения с уменьшением диаметра до 2,5 мм и после патентирования образцов диаметром 2,5 мм*

		Предел прочности на разрыв, МПа	Относительное равномерное удлинение, %	Общее удлинение, %
Проволока после волочения с уменьшением диаметра до 2,5 мм	Базисная сталь	1644	1.2	1.5
	Сталь, легированная бором	1592	1.0	1.1
	Высоколегированная сталь с высоким содержанием бора	1677	1.2	1.5
Патентированная проволока диаметром 2,5 мм	Базисная сталь	1324	7.3	8.6
	Сталь, легированная бором	1317	6.7	8.9
	Высоколегированная сталь с высоким содержанием бора	1277	6.7	9.1

	Предел прочности на разрыв, МПа	Относительное равномерное удлинение, %	Общее удлинение, %	Nt	Nb
Базисная сталь	2106	1.1	2.1	41	12
Сталь, легированная бором	2096	1.3	2.4	42	11
Высоколегированная сталь с высоким содержанием бора	2087	1.4	2.5	41	9

▲ **Таблица 4.** *Механические свойства при растяжении: предел прочности на разрыв (UTS), относительное равномерное удлинение (UE) и общее удлинение (TE) тянутой проволоки диаметром 1 мм после патентирования*

	Предел прочности на разрыв, МПа	Относительное равномерное удлинение, %	Общее удлинение, %	Nt	Nb
Базисная сталь	2263	0.4	1.5	35	11
Сталь, легированная бором	2283	0.4	1.5	36	10
Высоколегированная сталь с высоким содержанием бора	2257	0.4	1.5	36	8

▲ **Таблица 5.** *Механические свойства при растяжении: результаты оценки предела прочности на разрыв (UTS), относительного равномерного удлинения (UE) и общего удлинения (TE) патентированной проволоки диаметром 1 мм после испытания на старение при температуре 150 °C в течение одного часа*

относительного удлинения при разрыве снизились до 0,4 % (равномерное удлинение) и 1,5 % (общее удлинение). Аналогичные значения удлинения были получены для всех сплавов. Количество витков до обрыва также было аналогичным для всех сплавов, хотя и меньшим, нежели в образцах, не подвергнутых старению. Тенденция к уменьшению числа знакопеременных изгибов с увеличением содержания бора вновь наблюдается в образцах в состаренном состоянии. При этом для всех сталей их число в образцах в состаренном состоянии примерно на один изгиб меньше, чем в образцах в несостаренном состоянии. Это предполагает, что легирование бором не оказывает существенного влияния на пластичность при том количестве азота, которое содержалось в исследуемом материале. Следует отметить, что содержание азота в изучаемых плавках, составляющее приблизительно 40 весовых частей на миллион, является нижним пределом его содержания в сталях, производство которых ведется в промышленных масштабах.

Выводы

Изучено влияние, которое оказывает легирование бором стали с содержанием углерода 0,80 % на связывание «свободного» азота в примеси внедрения. В лабораторных условиях в дополнение к базисному сплаву, не содержащему бора, подготовлены плавки металла с массовым отношением бора к азоту, составляющем 1,4 и 2,4, выполнены горячая прокатка, волочение, патентирование, а также дополнительное волочение заготовок с уменьшением диаметра до конечной величины, равной 1 мм. Проведены исследования микроструктуры и оценка механических свойств при растяжении. Выявлено ограниченное влияние, которое легирование бором оказывает на свойства проволоки и, в частности, на пластичность при кручении, с учетом того количества азота, которое содержалось в исследуемом материале. В образцах из высоколегированной стали с высоким содержанием бора наблюдалось снижение предела прочности при растяжении. ■

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Dätwyler réalise le câblage du nouveau centre de données de l'Association Régionale de la Rhénanie

DANS le but de rationaliser ses opérations, LVR-InfoKom, fabricant de systèmes de L'Association Régionale de la Rhénanie LVR, a agrandi son centre de données principal de Cologne en Allemagne et l'a transféré dans un nouveau bâtiment. Le contrat pour le nouveau câblage a été adjugé à Dätwyler qui a offert une solution globale économique et un délais d'achèvement rapide.

En 2009 LVR-InfoKom a décidé d'agrandir l'un de ses deux centres de données et de le transférer dans un nouveau bâtiment qui, en plus de la salle des serveurs, dispose également d'une série de salles multifonctions. Dans le nouveau centre de données, les composants actifs devaient être interconnectés au moyen d'un système de câblage à l'abri du vieillissement et de connexion au moyen d'un système de câblage top-of-rack.

Par conséquent, dans le secteur de la technologie du cuivre, ont été présentées des soumissions pour un système de classe EA avec une capacité de 10 giga bits. Pour le secteur de la fibre optique la LVR exigeait un câble multimode OM3 et pour la liaison avec l'extérieur des câbles monomodes OS2 assemblés à fibres gainées qui devaient être fournis complets de séparateurs et de connecteurs LCD préassemblés.

▲ *Nouveau centre de données de Dätwyler*

En plus des mesures d'acceptation et d'un essai fonctionnel sur le câblage, une garantie de 20 ans ainsi qu'un jeu complet de documents étaient requis pour le système, y compris la connexion des composants actifs. En outre, le projet de câblage étendu devait comprendre la construction des parcours des câbles, l'installation des coupe-feu entre les salles multifonctions et le logement des parcours des câbles dans les couloirs.

L'approche de Dätwyler pour l'exécution de la commande a consisté en l'application d'une stratégie clés en main. En l'espace de seulement quelques jours les équipes de Dätwyler ont été en mesure de poser les câbles de cuivre du type 7702, de les assembler avec les connecteurs et, enfin, de mesurer et documenter les segments de ligne (environ 100 avec une longueur totale de 16 kilomètres). Les câbles verticaux FO préassemblés (câbles multiples), pour un total de 210 lignes, étant dans la majorité des cas de 24 fibres chacune, comprenaient également des rapports d'essais dans une série de livraisons partielles et ont été installés immédiatement dans chaque cas.

En outre, 1 500 câbles de connexion à fibres optiques et en cuivre, 400 tableaux de connexion et boîtes de jonction ainsi qu'environ 200 tableaux de distribution optiques font partie du système.

Dätwyler – Allemagne
Website: www.datwyler.com

Investissement pour rationaliser la production

La société britannique Hutchinson Engineering de Widnes, en Cheshire, a décidé d'investir plus de 500 000 livres dans une nouvelle technologie pour rationaliser ses performances dans la production de mâts de téléphonie mobile et structures pour turbines éoliennes.

Le nouvel équipement Ficep, consistant en une Gemini de fabrication italienne conçue pour le forage, le taraudage, le fraisage, le marquage et le coupage thermique de l'acier pour un montant de 370 000 livres, et une PC600 de fabrication hollandaise conçue pour le découpage au profil de tubes pour une valeur de 140 000 livres, accélérera les opérations de fabrication et le processus de coupage en générant des pièces de qualité avec une meilleure adaptation et des temps de soudage réduits.

Cette nouvelle machine permettra à la société de fabriquer plus aisément des turbines éoliennes de dimensions supérieures (modèles de 50KW et 100KW) ainsi que d'améliorer les temps de fabrication et de livraison des bases de support des mats de télécommunication conçus pour O2 et Vodafone.

Hutchinson Engineering – Royaume-Uni Website: www.hutchinson-engineering.co.uk

Technologie DNA projetée pour combattre les vols

UN système d'alarme portable révolutionnaire conçu pour filmer les voleurs et les associer aux crimes en utilisant la technologie ADN à distance a été acclamé avec faveur par la police comme un pas important pour contribuer à combattre la forte croissance de vols de métal.

Le système AATTS (*Alarmed and Traceable Technology Solutions System*), développé par la société écossaise PID Systems de Kilmarnock, est le premier système d'alarme utile réalisé avec le but de protéger les propriétés et les lieux à risque qui a été approuvé et recommandé par l'Association des Chefs de Police (ACPO).

Il s'agit d'un système sans fils qui par conséquent n'exige pas d'être connecté à un réseau d'alimentation et peut être installé de façon rapide et facile. Outre à signaler acoustiquement la présence d'un intrus, il envoie un signal au propriétaire du local et à PID Systems et capture à vidéo toute tentative de vol.

Le dispositif anti-vandalisme utilise une couleur rouge ultraviolette indélébile, visible seulement avec la lumière ultraviolette. Il couvre les intrus avec un spécial agent de marquage moléculaire codé pouvant être associé avec la scène du crime.

Jacqui Shiel, directeur du développement pour l'initiative *Secured by Design* de l'Association des Chefs de Police (ACPO) a déclaré: "Le vol des métaux est un problème croissant qui peut être très coûteux à traiter tant du point de vue du coût des matériaux à remplacer que du point de vue des réparations. L'alarme immédiate d'un danger potentiel est essentielle pour prévenir cette intrusion et pour identifier les responsables.

"Le système AATTS de PID Systems est une arme efficace dans la lutte contre le vol des métaux pouvant être employé rapidement et aisément dans une grande variété de lieux internes et externes. Il utilise la toute dernière technologie pour offrir un système de détection et pré-alarme adaptable."

On a observé une forte augmentation de vols de métaux causée par la croissance des coûts globaux. Le prix du cuivre est augmenté de 889 livres an/tonne en novembre 2001 arrivant à 6 356 livres an/tonne enregistré l'année dernière. Selon le département HMRC (*Her Majesty's Revenue and Customs*), une quantité estimée en 10 000 cas de vols de métaux chaque année ont coûté à l'économie anglaise plus de 5 600 milliards de livres en pertes de revenu.

Parmi les cas les plus graves de vol de cuivre, il faut rappeler le cas de Network Rail, qui entre 2009 et 2010 a vu augmenter de 65% les vols de câbles pour le chemin de fer avec une perte de 16 000 heures de travail, et BT qui a assisté à une augmentation des vols de câbles de 12% par rapport à l'année précédente.

Graham Jones, MP pour Hyndburn, a présenté à la Chambre des Communes une proposition de loi pour prévenir le vol de métaux dans le but de renforcer les règlements et de rendre plus rigoureux le régime de licences pour les parcs à ferrailles. Une législation séparée sera introduite en Écosse.

PID Systems – Royaume-Uni
Website: www.pid-systems.co.uk

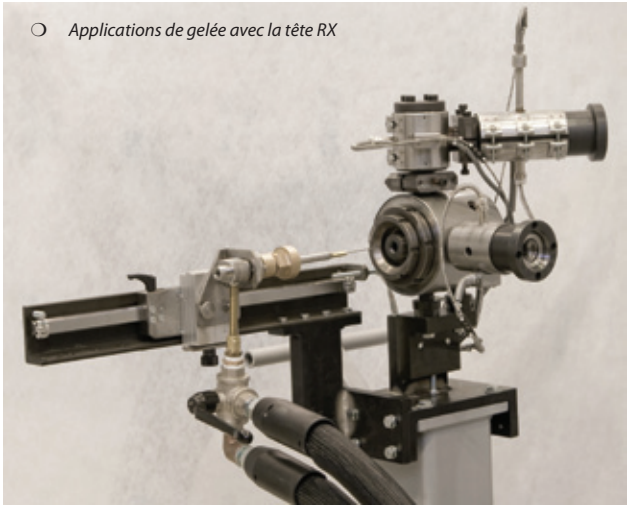
Rosendahl répond aux demandes du marché

Le principe des câbles à fibres optiques remplis de gelée continue à maintenir un pourcentage substantiel sur le marché de câbles à fibres optiques. Les têtes d'injection de la série RX de Rosendahl répondent à cette exigence avec un système modulaire d'injection de gelée fournit en option, équipé d'aiguilles aisément remplaçables et réglables, montées sur un système de guide linéaire de haute précision.

L'injection constante de gelée thixotrope et l'équilibre parfait du flux polymérique pour le distributeur de la tête d'injection RX garantissent une distribution uniforme et stable du composé pour câbles à fibres optiques à travers la zone de sortie.

Les têtes d'injection RX de Rosendahl sont généralement caractérisées par une haute précision de centrage, et permettent ainsi d'éviter le surdimensionnement de l'épaisseur de la paroi du câble et contribuent à réduire les coûts de matériau et de production.

La forme perfectionnée du canal d'écoulement s'adapte bien à la rhéologie des matériaux de revêtement spécifiques, garantit des temps brefs de séjour du polymère fondu et permet de changer la couleur ou le matériau de façon rapide et facile. La



❍ *Applications de gelée avec la tête RX*

structure compacte et modulaire associée à un centrage aisé et précis garantissent une manutention aisée.

La structure de la tête d'injection RX de Rosendahl évite toute déviation du processus et contribue à augmenter la qualité et le rendement des lignes d'extrusion pour câbles à fibres optiques remplis de gelée.

Rosendahl – Autriche
Website: www.rosendahlaustria.com

Effets des alliages au bore sur l'évolution microstructurelle et sur les propriétés mécaniques du fil à haute teneur en carbone

Par Emmanuel De Moor, Advanced Steel Processing and Products Research Centre, et Walther Van Raemdonck, NV Bekaert SA

Résumé

Les alliages au bore sont souvent appliqués à l'acier à faible teneur en carbone pour lier l'azote libre et éviter le vieillissement causé par la déformation avec pour résultat une amélioration de la ductilité (torsionelle) des produits à base de fil. Le présent article analyse les effets des alliages au bore sur les aciers à haute teneur en carbone (0,80 % poids). Des coulées ont été préparées en laboratoire avec le bore avec des rapports de bore et azote di 1:1 et 2:1, en plus d'une coulée de référence. Le matériau a été laminé à chaud, tréfilé, patenté et tréfilé davantage jusqu'à atteindre la dimension d'1mm. Les propriétés mécaniques et la caractérisation microstructurelle dans chaque phase intermédiaire ont été évaluées. Des effets limités des alliages au bore sur les propriétés mécaniques étaient évidents.

Introduction

Le four à arc électrique est de plus en plus employé pour les opérations de production de l'acier pour les produits longs, surtout en Amérique du Nord.

Le remplacement de l'acier effervescent avec l'acier produit dans les coulées continues dans les fours à arc électrique (EAF) impose des défis en ce qui concerne les exigences de qualité des produits par rapport à la ductilité (torsionelle). Cela se réfère à la teneur en azote intrinsèquement plus élevée de l'acier produit dans un four à arc électrique. Si l'azote se répand, il peut entraîner le vieillissement par déformation avec un durcissement majeur et une ductilité mineure du produit à base de fil[1].

Des recherches importantes ont été effectuées pour réduire la teneur en azote libre dans les nuances d'acier à faible teneur en carbone au moyen d'alliages avec micro-additions, par exemple de bore, vanadium ou niobium.[1-6] L'alliage de bore de l'acier à haute teneur en carbone[7] a reçu une attention moindre et il fait l'objet de la présente étude.

Procédur expérimentale

Le bore peut se combiner avec l'azote pour former du nitrure de bore de la façon suivante:

$$B + N = BN \quad (1)$$

et la stœchiométrie correspond à un rapport B:N de 11:14 ou 0,79 en fonction des poids anatomiques du bore et de l'azote.

Pour cette étude, trois alliages ayant une teneur en carbone de 0,80 pct pds ont été mis au point afin d'obtenir un alliage de référence, un alliage avec bore et azote dans une relation stœchiométrique et un alliage superstœchiométrique avec un rapport B:N de 2:1.

Ce dernier acier permet d'étudier l'effet du bore "libre" supplémentaire sur le développement microstructurel et sur les propriétés microstructurelles.

Le *Tableau 1* illustre les compositions des barres préparées en laboratoire; à remarquer que les rapports dans les compositions "brut de coulée" (as-cast) étaient légèrement supérieurs par rapport au projet, c'est-à-dire 1,44 et 2,39 respectivement dans les alliages de B et avec une haute teneur en B.

Par conséquent, le bore libre peut être présent également dans l'alliage de B. Les lingots ont été laminés à chaud dans

▼ **Tableau 1** – *Composition chimique en pct pds de l'acier préparé en laboratoire*

	C	Mn	Si	Cr	B, ppm	N, ppm
Base	0.78	0.48	0.25	0.20	-	42
B	0.82	0.46	0.23	0.20	62	43
Haute teneur en B	0.76	0.47	0.23	0.20	98	41

un laminoir chargé manuellement, en effectuant un réchauffage à 1176°C et la réduction en trois phases sur deux laminoirs à chaud. Au début, les barres ont été réduites de 12,7 à 9,5cm, pour obtenir des barres carrées avec des angles arrondis (*RCS - Round Corner Square*) ensuite refroidies avec de l'air jusqu'à une température ambiante, réchauffées et laminées jusqu'à 4,76cm.

Ensuite, le matériau a été usiné pour éliminer les oxydes et coupé en 6-7 blocs.

La réduction finale a été réalisée dans un deuxième laminoir à chaud jusqu'à atteindre la dimension finale de 7,1mm.

Après le laminage à chaud, le matériau a été refroidi avec de l'air jusqu'à une température ambiante. Ensuite, le matériau a été coupé au moyen d'une scie en morceaux de 3,7m, avant d'être tréfilé. Vingt-quatre sections de chaque alliage ont été obtenues.

Bien que les calculs thermodynamiques au moyen du programme Thermo-Calc® prévoyaient une fragilité à chaud potentielle de l'acier à haute teneur en B, aucune rupture ni défaut superficiel significatif n'ont été observés.

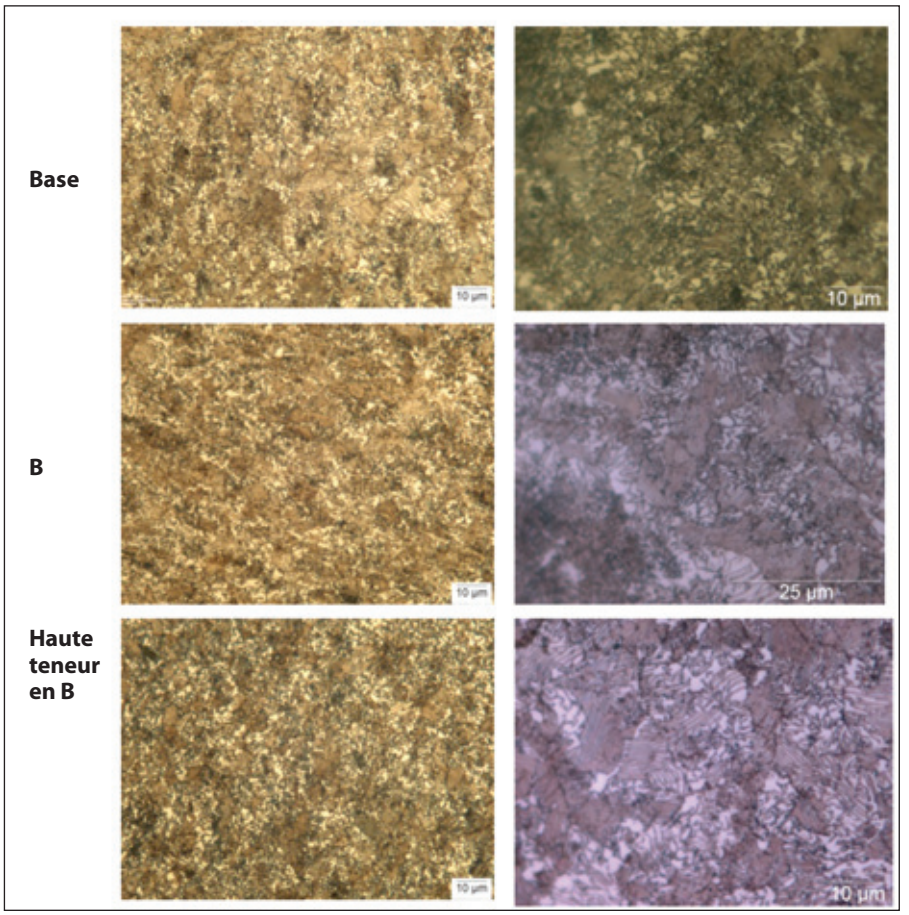
Une décarburation significative ayant été observée[8], le matériau a été rectifié sans centres jusqu'à un diamètre de 5,5mm. Ensuite, la présence de ségrégation de carbone dans les barres laminées à chaud a été évaluée et seules les barres qui présentaient une teneur en carbone de 0,78 ± 0,01 pct pds pour le tréfilage de fil successif ont été sélectionnées.

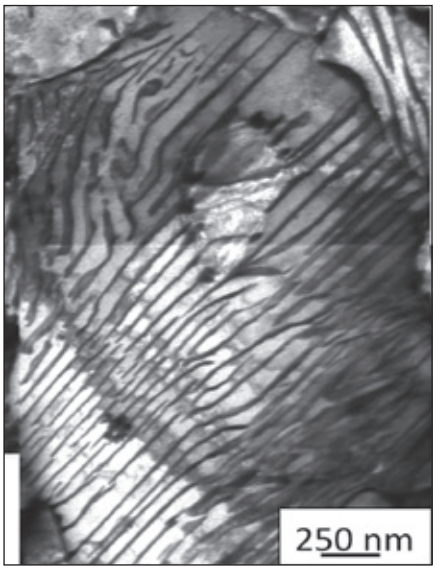
Le tréfilage de fil a été effectué auprès du Bekaert Technology Centre en appliquant une réduction à 2,5mm de diamètre en huit pas de tréfilage. Ensuite, le patentage a été effectué dans des bains de sel avec un réchauffage à 980°C puis à 520°C. Le fil patenté a été tréfilé davantage jusqu'à 1mm.

Un essai de traction a été effectué sur une machine électromécanique à une vitesse de déformation constante de 5,6 10^{-4} /s, au moyen d'un extensomètre de 5cm à 50%. Deux échantillons ont été essayés pour chaque condition.

Les déformations uniformes ont été définies comme tension d'étude à la charge de pointe utilisée pour les calculs de la tension à la rupture (*UTS - Ultimate Tensile Strength*), et les tensions à la rupture totales ont été obtenues de la

▼ **Figure 1**: *Micrografies optiques lumineuses de barres laminées à chaud en acier de Base, au bore et à haute teneur en bore. Échantillons prélevés transversalement par rapport à la direction de laminage, au centre de la section transversale, gravure 4% Picral*





▲ **Figure 2**: *Micrographe électronique à transmission du matériau à haute teneur en B, laminé à chaud et refroidi*

de réchauffage constante de 20°C/s et ont été maintenus isothermiques pendant cinq minutes. Ensuite, l'acier a été refroidi en gaz hélium à des vitesses de refroidissement constantes programmées respectivement de 50, 30, 25, 12,5, 10, 7,5, 5, 2,5 et 1°C/s. Des essais consécutifs ont été effectués sur un seul échantillon pour chaque alliage. La dilatation de l'échantillon a été surveillée en tenant compte de la température et du temps.

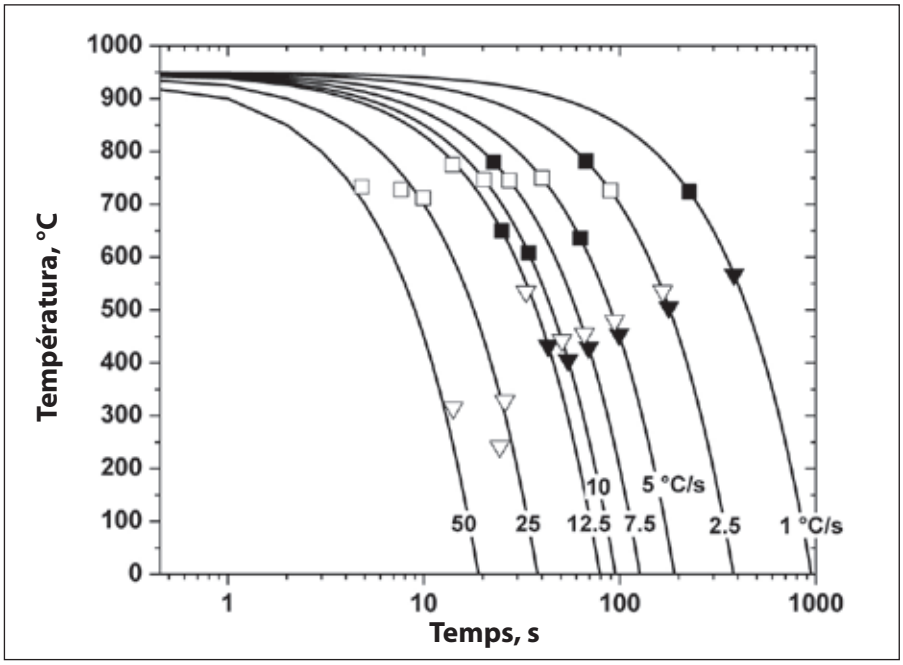
Résutats et discussion

Les micrographies optiques lumineuses éffectuées à la moitié de la section transversale des barres laminées à chaud sont représentées aux *Figure 1*.

Des microstructures perlitiques peuvent être observées. Aucun réseau de constituants proeutectoïdes n'a pas été observé. L'analyse TEM de l'acier lié superstoechiométriquement a été effectuée pour évaluer l'effet du bore libre sur l'évolution microstructurelle et une micrographie TEM représentative est illustrée à la *Figure 2*.

La présence de martensite n'a pas été détectée ce qui indique probablement que le bore n'augmente pas la trempabilité. On sait que le bore augmente considérablement la trempabilité dans les aciers à faible teneur en carbone[9].

Toutefois, il a été reporté que cet effet est moins prononcé dans les aciers à haute teneur en carbone.[10,11]. Afin de vérifier l'effet de l'alliage sur la trempabilité, la dilatométrie a été effectuée sur la base et sur l'alliage au bore comme exposé dans la référence 12.



▲ **Figure 3**: *Températures initiale (carrés) et finale (triangles) de transformation pour différentes vitesses de refroidissement constant. Symbols pleins: alliage de base et symboles ouverts: acier au B*

L'essai a démontré que l'alliage au bore entraînait une réduction de la trempabilité comme l'illustre la *Figure 3*, qui indique les températures de transformation initiale et finale pour les alliages de base et au bore à une température en fonction du diagramme du temps.

Comme l'on peut remarquer, différentes vitesses de refroidissement constant ont été examinées. À une vitesse de refroidissement de 25 et 50°C/s, la transformation de la martensite a été le seul mécanisme de décomposition détecté dans l'alliage de base, tandis qu'on a remarqué la transformation de perlite dans l'acier au bore. En outre, l'acier au bore a mis en évidence une zone plus ample de transformation de la perlite.

Les courbes tension-déformation et les propriétés de traction des barres laminées à chaud sont indiquées à la *Figure 4* et a u *Tableau 2*. Les aciers de base et au B montrent des comportements de tension-déformation très similaires bien que l'acier au B montre un allongement de la limite apparente d'élasticité (*YPE - Yield Point Elongation*) tandis que l'acier de base montre une déformation continue, c'est-à-dire uniforme (*round-house*).

L'événement de l'allongement de la limite d'élasticité peut être plutôt inattendue étant donné que l'alliage été conçu pour tenir l'azote lié au bore et donc l'allongement de la limite d'élasticité ne devrait pas être déterminée par le vieillissement par déformation de l'azote 'libre'. Par conséquent, le comportement se réfère vraisemblablement au vieillissement par déformation du carbone.

Il faut remarquer que les barres ont été redressées à température ambiante après le laminage à chaud et, dans certains cas, une déformation non uniforme durant le redressement peut avoir déterminé l'élimination de l'allongement de la limite d'élasticité. Des résistances à la traction et des allongements similaires ont été obtenus dans l'acier de base et dans l'acier au B.

L'acier à haute teneur en B a montré des valeurs de résistance inférieures; il est possible de remarquer une déformation uniforme à des valeurs de résistance inférieures par rapport à d'autres aciers et une valeur de résistance à la traction inférieure d'environ 25 MPa a été obtenue.

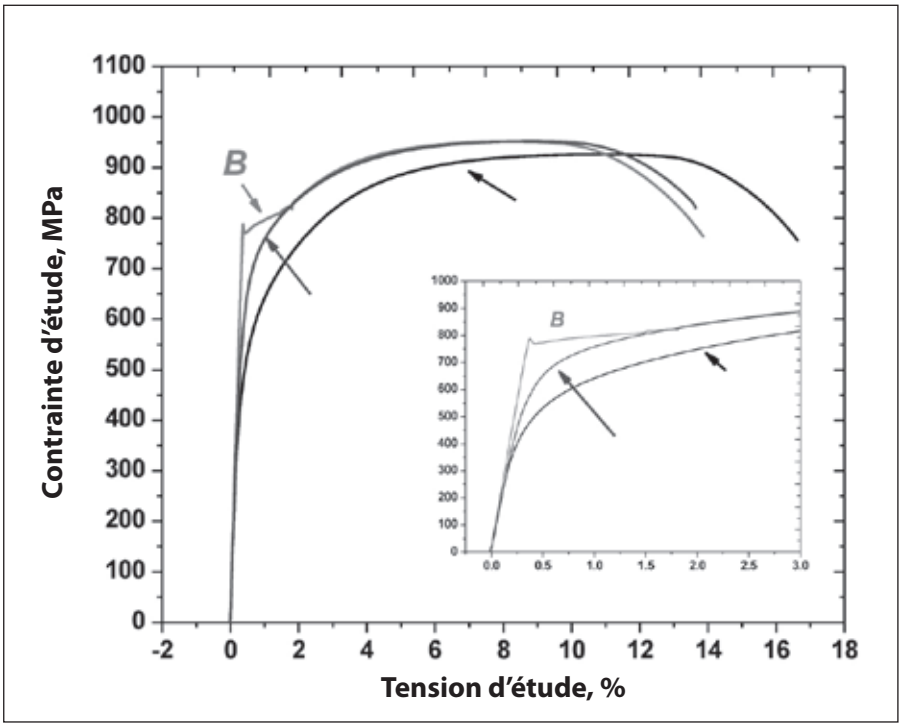
Cette différence de résistance ne peut être attribuée au carbone, des échantillons avec la même teneur en carbone ayant été sélectionnés pour les essais. L'acier à haute teneur en B a montré un allongement à la traction supérieur. Il est intéressant de remarquer qu'une résistance à la traction réduite avec alliage de bore est en ligne avec les études précédentes concernant les aciers à teneur en carbone faible1 et haute7 et avec une majeure trempabilité observée dans l'étude de la dilatométrie. Une cinétique de la transformation de la perlite majeure peut entraîner une augmentation des espaces lamellaires et/ou de la perlite à plus gros grain.

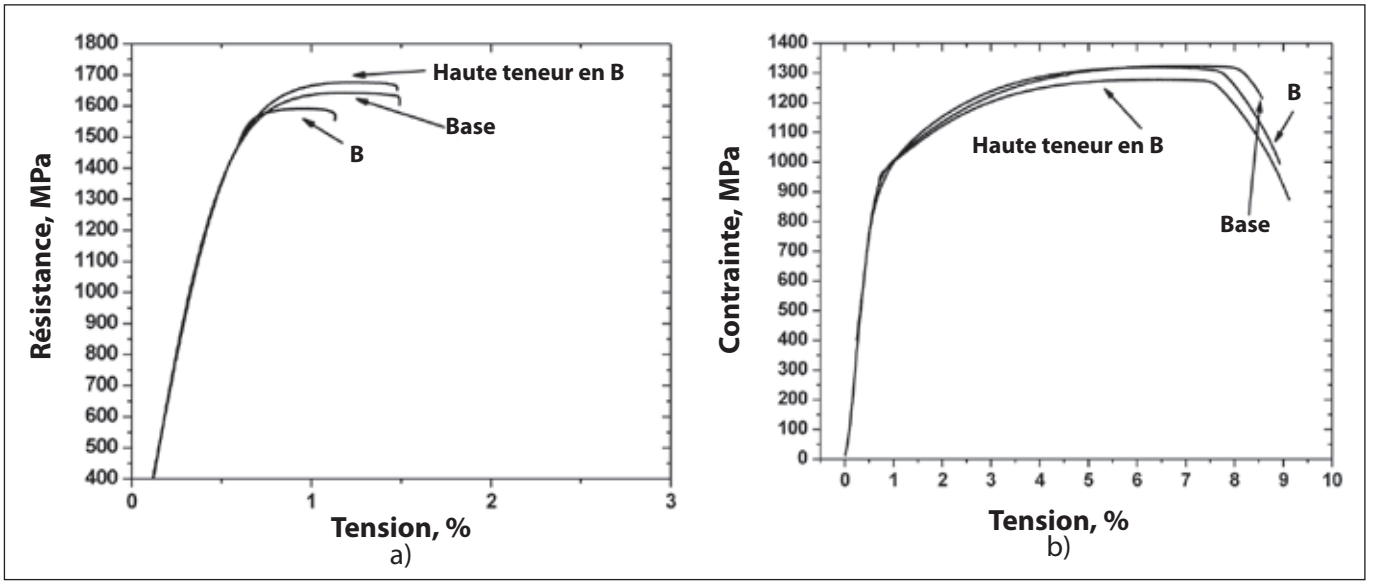
On peut également objecter que le niveau de résistance réduit peut être mis

▼ **Tableau 2** – *Propriétés de traction des barres laminées à chaud*

	UTS, MPa	UE, %	TE, %
Base	952	9.4	13.7
B	951	8.2	13.9
Haute teneur en B	926	11.2	16.6

▼ **Figure 4**: *Courbes de tension-déformation des barres laminées à chaud*





▲ **Figure 5**: *Courbes de tension-déformation du fil a) tréfilé jusqu'à 2,5mm et b) patenté à 2,5mm*

		UTS, MPa	UE, %	TE, %
Tréfilé jusqu'à 2,5mm	Base	1644	1.2	1.5
	B	1592	1.0	1.1
	Haute teneur en B	1677	1.2	1.5
Patenté à 2,5mm	Base	1324	7.3	8.6
	B	1317	6.7	8.9
	Haute teneur en B	1277	6.7	9.1

▲ **Tableau 3** – *Propriété de traction, tension de rupture (UTS), Allongement uniforme (UE) et Allongement total (TE) des fils tréfilés à 2,5mm et patentés à 2,5mm*

en relation avec un durcissement de la solution solide réduit. Toutefois, il faut remarquer que l'alliage de B ne montre aucune diminution de la résistance par rapport à l'alliage de base. Précédemment il a été suggéré que la réduction de la résistance est associée à un effet liant dans la transformation d'austenite à ferrite1 ou perlite11.

Les propriétés mécaniques résultant du tréfilage de fil jusqu'à 2,5mm de diamètre sont représentées à la *Figure 5a* et au *Tableau 3*. Dans la condition de tréfilage, l'acier au B montre la résistance à la traction et l'allongement les plus bas, et l'acier à haute teneur en B montre la résistance à la traction la plus élevée et un allongement supérieur par rapport à l'acier au B.

L'acier de base montre un allongement uniforme et un allongement total similaire par rapport à l'acier à haute teneur en B, malgré une résistance à la traction inférieure. Il faut remarquer que des pannes se sont vérifiées aux poignées de traction qui ont probablement influencé les valeurs d'allongement globales.

Les propriétés de traction obtenues après le patentage à 2,5mm de diamètre sont indiquées à la *Figure 5b* et au *Tableau 3*. Des tensions de rupture similaires sont obtenues dans l'acier de Base et dans l'acier au B, tandis que l'acier à haute teneur en B montre une tension de rupture inférieure d'environ 50MPa. Cette résistance mineure peut être encore référée à une augmentation de la cinétique de décomposition de l'austenite. Une valeur d'allongement légèrement supérieure est obtenue pour les deux aciers au bore.

Les fils patentés ont été ensuite tréfilés jusqu'à 1mm de diamètre avec des passes consécutives; les propriétés de traction en plus du nombre de torsions à rupture (N_t) et du nombre de pliages inversés (N_b), sont indiquées au *Tableau 4*. Il est encore évident qu'une diminution de la résistance à la traction de l'alliage au bore et une faible augmentation de l'allongement uniforme et total. Toutefois, le nombre de torsions jusqu'à rupture n'est pas altéré par l'alliage, tandis que l'on peut remarquer une faible diminution du nombre de pliages inversés avec des niveaux de bore majeurs.

Pour évaluer la réponse au vieillissement du fil tréfilé à 1 mm, un vieillissement isothermique à 150°C a été effectué pendant une heure dont les résultats sont illustrés au *Tableau 5*.

Une augmentation de la résistance à la traction d'environ 170MPa a été obtenue tandis que les allongements à la traction ont été réduits à 0,4% de l'allongement uniforme et à 1,5% de l'allongement total. Des allongements similaires ont été obtenus dans la totalité des alliages.

Des valeurs de torsion jusqu'à rupture similaires à celles des matériaux non soumis à vieillissement ont été d'ailleurs remarquées dans la totalité des alliages bien qu'à des niveaux inférieurs.

La tendance à obtenir un nombre inférieur de pliages inversés avec l'augmentation des niveaux de bore a été observée encore

▼ **Tableau 4** – *Propriété de traction, tension de rupture (UTS), Allongement uniforme (UE) et Allongement total (TE) des fils tréfilés à 1mm après le patentage*

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2106	1.1	2.1	41	12
B	2096	1.3	2.4	42	11
	2087	1.4	2.5	41	9

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2263	0.4	1.5	35	11
B	2283	0.4	1.5	36	10
Haute teneur en B	2257	0.4	1.5	36	8

▲ **Tableau 5** – *Propriété de traction, tension de rupture (UTS), Allongement uniforme (UE) et Allongement total (TE) évalués après vieillissement à 150°C pendant une heure des fils tréfilés à 1mm après le patentage*

dans des conditions de vieillissement et on a obtenu environ un pliage en moins dans la condition de vieillissement par rapport à la condition de non vieillissement pour la totalité des aciers. Cela indique que l'alliage de bore n'influence pas significativement la ductilité aux niveaux d'azote étudiés. Il faut remarquer que les niveaux d'azote d'environ 40ppm des coulées actuelles représentent la partie de matériau produit industriellement avec des caractéristiques de qualité inférieures.

Conclusions

L'effet de l'alliage au bore des aciers avec 0,80C pour lier l'azote interstitiel "libre" a été étudié. Des coulées avec des rapports B:N de 1,4 et 2,4 ont été préparées en laboratoire en plus d'un alliage de base sans bore, laminées à chaud, tréfilées et patentées et encore tréfilées jusqu'à obtenir un diamètre final de 1mm. On a effectué la caractérisation microstructurelle et les propriétés de traction ont été évaluées. L'effet limité de l'alliage de bore sur les propriétés du matériau de fil, en particulier sur la ductilité torsionnelle a été évident. Une tension de rupture réduite a été observée dans les aciers à haute teneur en B. ■

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Dätwyler realizza il cablaggio del nuovo centro dati dell'Associazione Regionale della Renania

IN vista di razionalizzare le proprie operazioni, LVR-InfoKom, società di servizi e di consulenza in informatica per l'associazione Regionale della Renania LVR, ha ampliato il proprio centro di dati principale di Colonia, in Germania, e lo ha trasferito in un nuovo edificio. Il contratto per il nuovo cablaggio è stato conferito a Dätwyler, che ha offerto una soluzione globale economica ed una veloce gestione.

Nel 2009, LVR-InfoKom ha deciso di ampliare uno dei suoi centri dati e di trasferirlo in un nuovo edificio che, oltre alla sala server, comprende anche una serie di sale polifunzionali. Nel nuovo centro dati tutti i componenti attivi dovevano essere interconnessi mediante un sistema di cablaggio "top-of-rack" adeguato alle esigenze future.

▲ *Nuovo centro dati di Dätwyler*

Pertanto, nel settore della tecnologia del rame, gli appaltatori sono stati invitati per un sistema EA con una capacità di 10 gigabyte. Per il settore della fibra ottica, la LVR richiedeva un cavo multimodale OM3 e per il collegamento con l'esterno, cavi monomodali OS2 con fibra rivestiti che dovevano essere forniti completi di ripartitori e connettori LCD preassemblati.

Oltre alle misure di accettazione e alla prova funzionale del cablaggio, per il sistema era richiesta una garanzia di 20 anni e un set completo di documentazione, che doveva anche includere il collegamento dei componenti attivi. Il progetto di cablaggio ampliato doveva inoltre comprendere la costruzione dei percorsi dei cavi, l'installazione delle barriere tagliafuoco fra le sale polifunzionali e l'alloggiamento dei percorsi di cavo nei corridoi.

L'approccio di Dätwyler per l'esecuzione dell'ordine è consistito nell'applicare una strategia chiavi in mano. Entro solo pochi giorni, con gli equipaggiamenti di Dätwyler è stato possibile posare i cavi di rame tipo 7702, assemblarli con i connettori e infine misurare e documentare i segmenti di linea, circa 1000 con una lunghezza totale di 16 chilometri.

I cavi di collegamento a fibra ottica preassemblati (cavi multipli), per un totale di 210 linee, nella maggioranza dei casi di 24 fibre ciascuno, furono recapitati unitamente ai protocolli di misurazione in una serie di consegne parziali e furono installati immediatamente in ciascun caso.

Altri 1500 cavi di interconnessione di fibra ottica e rame, 400 pannelli di interconnessione e cassette di giunzione nonché circa 200 pannelli di distribuzione ottica, fanno parte del sistema.

Dätwyler – Germania
Website: www.datwyler.com

Investimento per razionalizzare la produzione

La società britannica Hutchinson Engineering di Widnes, Cheshire, ha deciso di investire più di 500.000 sterline in nuova tecnologia per razionalizzare la propria prestazione nella produzione di piloni per la telefonia mobile e strutture per le turbine eoliche.

Il nuovo equipaggiamento Ficep, costituito da una Gemini di fabbricazione italiana progettata per la foratura, la maschiatura, la fresatura, la marcatura e il taglio termico di acciaio del valore di 370.000 Sterline, e da una PC600 di fabbricazione olandese progettata per la profilatura di tubi del valore di 140.000 Sterline, velocizzerà le operazioni di fabbricazione e il processo di taglio realizzando pezzi di qualità con un migliore adattamento e tempi di saldatura inferiori.

Questo nuovo macchinario consentirà alla società di realizzare con maggiore facilità turbine eoliche di dimensioni superiori (modelli da 50KW e 100KW). Inoltre, migliorerà i tempi di fabbricazione e consegna delle piastre di supporto per i piloni di telecomunicazioni progettati per O2 e Vodafone.

Hutchinson Engineering – Regno Unito
Website: www.hutchinson-engineering.co.uk

Rosendahl soddisfa le richieste

Il principio dei cavi a fibre ottiche riempiti di gelatina continua a mantenere una percentuale sostanziale sul mercato dei cavi a fibre ottiche. Le teste trasversali serie RX di Rosendahl soddisfano questa domanda con un sistema modulare di iniezione di gelatina fornito in opzione, equipaggiato con aghi facili da sostituire e regolare, montati su un sistema di guida lineare di alta precisione.

L'iniezione costante di gelatina tixotropica e il perfetto equilibrio del flusso polimerico per il distributore della testa trasversale RX garantiscono una distribuzione uniforme e stabile del composto per cavi a fibre ottiche attraverso la zona di uscita.

Le teste trasversali RX di Rosendahl sono generalmente caratterizzate da un'elevata precisione di centraggio, evitando così il sovradimensionamento dello spessore della parete del cavo e contribuendo a ridurre i costi di materiale e di produzione.

La forma perfezionata del canale di flusso si adatta alla reologia dei materiali di rivestimento speciali, garantisce tempi di permanenza brevi del polimero fuso e consente di cambiare il colore o il materiale in modo rapido e facile. La

❍ *Applicazioni di gelatina con la testa trasversale RX*

struttura compatta e modulare associata ad un centraggio agevole e accurato garantiscono una facile manipolazione.

La struttura della testa trasversale RX di Rosendahl evita deviazioni nel processo e contribuisce ad aumentare la qualità e l'efficienza nelle linee di estrusione per cavi a fibra ottica riempiti di gelatina.

Rosendahl – Austria
Website: www.rosendahlaustria.com

Tecnologia DNA progettata per combattere i furti

UN rivoluzionario sistema di allarme portatile progettato per filmare i ladri e collegarli ai crimini in siti remoti mediante l'utilizzo della tecnologia DNA, è stato accolto con favore dalla polizia come un passo importante per contribuire a combattere l'aumento massiccio di furti di metallo.

Il sistema AATTS (*Alarmed and Traceable Technology Solutions System*), sviluppato dalla società scozzese PID Systems di Kilmarnock, è il primo sistema di allarme utile realizzato con l'obiettivo di proteggere le proprietà e i luoghi a rischio che è stato approvato e raccomandato dall'Associazione dei Capi di Polizia (ACPO).

Si tratta di un sistema senza fili che pertanto non richiede la connessione ad una rete di alimentazione e può essere installato in modo rapido e facile. Oltre a segnalare acusticamente la presenza di un intruso, invia un segnale al proprietario del locale e a PID Systems e acquisisce sul video qualsiasi tentativo di furto.

Il dispositivo antivandalismo utilizza inoltre un colore rosso ultravioletto indelebile, visibile solo con la luce ultravioletta. Ricopre gli intrusi con un particolare agente di marcatura molecolare codificato che può essere associato alla scena del crimine.

Jacqui Shiel, direttore dello sviluppo per l'iniziativa *Secured by Design* dell'Associazione dei Capi di Polizia (ACPO) ha dichiarato: "Il furto di metalli è un problema crescente che può essere molto costoso da gestire, sia per quanto riguarda il costo dei materiali di sostituzione, sia per le riparazioni. L'allarme immediato di un potenziale problema è fondamentale per evitare questa intrusione e identificare i colpevoli.

"Il sistema AATTS di PID Systems è un'arma efficace nella lotta contro il furto di metalli poiché può essere impiegata rapidamente e facilmente in una gran varietà di luoghi interni ed esterni. Utilizza la tecnologia più recente per offrire un sistema di rilevamento e preallarme adattabile."

È stato osservato un aumento consistente dei furti di metalli, causato dalla crescita dei costi globali. Il prezzo del rame è aumentato da 889 Sterline anno/t nel novembre 2001 a 6.356 Sterline anno/t dello scorso anno. Secondo il dipartimento HMRC (*Her Majesty's Revenue and Customs*), una quantità stimata in 10.000 casi di furto di metalli ogni anno sono costati all'economia inglese più di 5.600 miliardi di sterline di perdite di ricavo.

Fra i casi di furto di rame più gravi va citato il caso di Network Rail, che fra il 2009 e il 2010 ha visto aumentare del 65% i furti di cavi per la ferrovia, con conseguente perdita di 16.000 ore di lavoro e BT che ha assistito ad un aumento dei furti di cavi del 12% rispetto l'anno precedente.

Graham Jones, MP per Hyndburn, ha presentato alla Camera dei Comuni una proposta di legge per prevenire il furto di metalli allo scopo rafforzare i regolamenti e rendere più rigoroso il regime di licenze per i parchi rottami. In Scozia verrà introdotta una legislazione separata.

PID Systems – Regno Unito
Website: www.pid-systems.co.uk

Effetti delle leghe di boro sull'evoluzione microstrutturale e sulle proprietà meccaniche del filo ad alto tenore di carbonio

A cura di Emmanuel De Moor, Advanced Steel Processing and Products Research Centre, e Walther Van Raemdonck, NV Bekaert SA

Riassunto

Le leghe di boro sono frequentemente applicate all'acciaio a basso tenore di carbonio per legare l'azoto libero ed evitare l'invecchiamento causato da deformazione con conseguente miglioramento della duttilità (torsionale) dei prodotti a base di filo.

Il presente articolo analizza gli effetti delle leghe di boro sugli acciai ad alto tenore di carbonio (0,80 % peso). Sono state preparate delle colate in laboratorio con il boro con rapporti di boro e azoto di 1:1 e 2:1, oltre ad una colata di riferimento. Il materiale è stato laminato a caldo, trafilato, patentato e ulteriormente trafilato fino a raggiungere la dimensione di 1mm.

Sono state valutate le proprietà meccaniche e la caratterizzazione microstrutturale in ciascuno stadio intermedio. Erano evidenti effetti limitati delle leghe di boro sulle proprietà meccaniche.

Introduzione

Sempre più spesso e specialmente nel Nord America, viene utilizzato il forno elettrico ad arco per le operazioni di produzione di acciaio per prodotti lunghi. La sostituzione di acciaio effervescente con acciaio prodotto in colate continue nei forni ad arco elettrico (EAF) impone delle sfide per quanto riguarda i requisiti di qualità dei prodotti rispetto alla duttilità (torsionale).

Ciò si riferisce al tenore di azoto intrinsecamente più elevato dell'acciaio prodotto in un forno elettrico ad arco. Se l'azoto si diffonde, può provocare invecchiamento da deformazione con conseguente maggiore incrudimento e minore duttilità del prodotto a base di filo[1].

Sono state effettuate importanti ricerche per ridurre il contenuto di azoto libero nei tipi di acciaio a basso contenuto di carbonio mediante leghe con micro aggiunte, ad esempio, di boro, vanadio o niobio.[1-6]

La lega di boro dell'acciaio ad alto tenore di carbonio è stata oggetto di minore attenzione[7] ed è il tema trattato dal presente studio.

Procedimento sperimentale

Il boro si può combinare con l'azoto per formare nitruro di boro nel modo seguente,

$$B + N = BN \quad (1)$$

e la relativa stechiometria corrisponde ad un rapporto B:N di 11:14 o 0,79 a seconda dei pesi atomici del boro e dell'azoto.

Per questo studio, sono state messe a punto tre leghe con contenuto di carbonio di 0,80 di percentuale in peso allo scopo di ottenere una lega di riferimento, una lega con boro e azoto in una relazione stechiometrica ed una lega superstechiometrica con un rapporto B:N di 2:1.

Quest'ultimo acciaio consente di studiare l'effetto del boro "libero" aggiuntivo sullo sviluppo microstrutturale e sulle proprietà microstrutturali.

La *Tabella 1* illustra le composizioni dei lingotti preparati in laboratorio; va notato che i rapporti nelle composizioni "allo stato grezzo"(as-cast) erano lievemente superiori rispetto a quanto progettatto, cioè 1,44 e 2,39 rispettivamente nelle leghe di B e con alto tenore di B. Pertanto, il boro libero può essere presente anche nella lega di B.

I lingotti sono stati laminati a caldo in un laminatoio caricato manualmente, effettuando un riscaldamento a 1176°C e la riduzione in tre fasi su due laminatoi a caldo.

▼ **Tabella 1** – *Composizione chimica espressa in percentuale di peso dell'acciaio preparato in laboratorio*

	C	Mn	Si	Cr	B, ppm	N, ppm
Base	0.78	0.48	0.25	0.20	-	42
B	0.82	0.46	0.23	0.20	62	43
Alto contenuto di B	0.76	0.47	0.23	0.20	98	41

Inizialmente, le barre sono state ridotte da 12,7 a 9,5cm, ottenendo barre quadrate con angoli arrotondati (*RCS - Round Corner Square*) e successivamente raffreddate con aria fino a temperatura ambiente, riscaldate e laminate fino a 4,76cm.

Quindi il materiale è stato lavorato a macchina per eliminare gli ossidi e tagliato in 6-7 blocchi.

La riduzione finale è stata realizzata in un secondo laminatoio a caldo fino a raggiungere la dimensione finale di 7,1mm. Dopo la laminazione a caldo, il materiale è stato raffreddato con aria fino a temperatura ambiente.

Quindi il materiale è stato tagliato con una sega in pezzi da 3,7m, prima di essere trafilato. Sono state ottenute ventiquattro sezioni di ciascuna lega. Sebbene in base ai calcoli termodinamici mediante il programma Thermo-Calc® fosse prevista una potenziale fragilità a caldo dell'acciaio ad alto tenore di B, non sono state osservate rotture o difetti superficiali significativi.

Essendo stata osservata una significativa decarburizzazione[8], il materiale è stato molato senza centri fino ad un diametro di 5,5mm.

Quindi è stata valutata la presenza di segregazione di carbonio nelle barre laminate a caldo e sono state selezionate solamente quelle che presentavano un contenuto di carbonio di 0,78 ± 0,01 di percentuale in peso per la successiva trafilatura di filo.

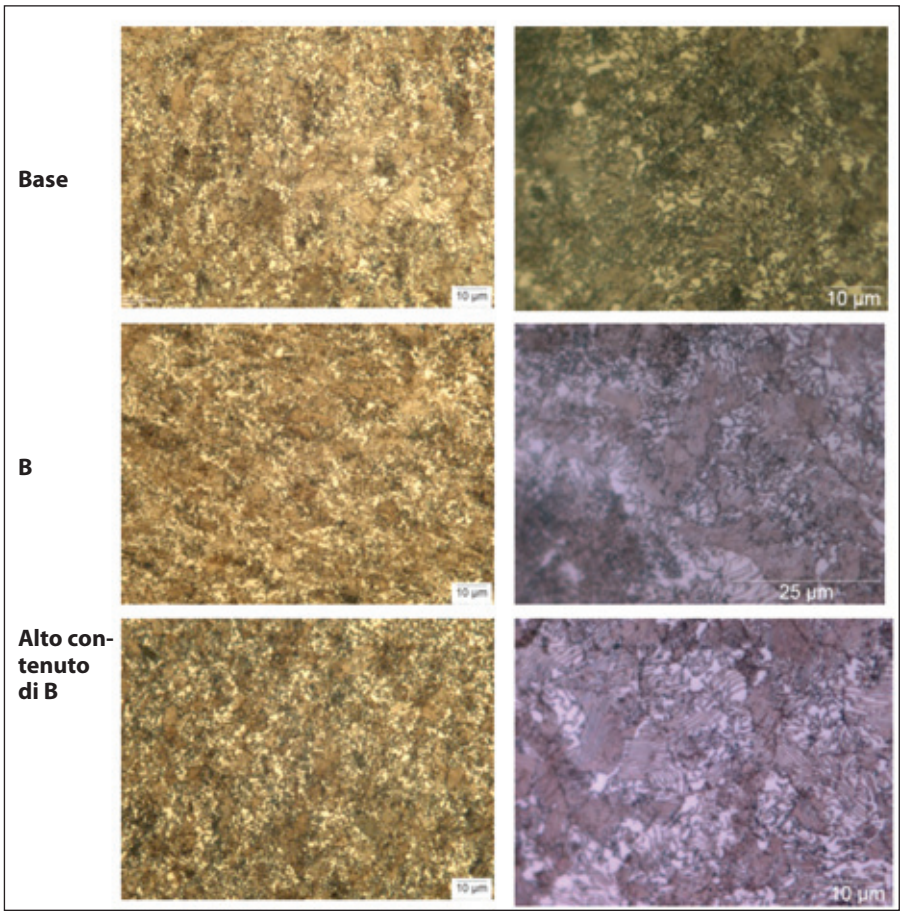
La trafilatura di filo è stata eseguita presso il Bekaert Technology Centre applicando una riduzione a 2,5mm di diametro in otto passi di trafilatura.

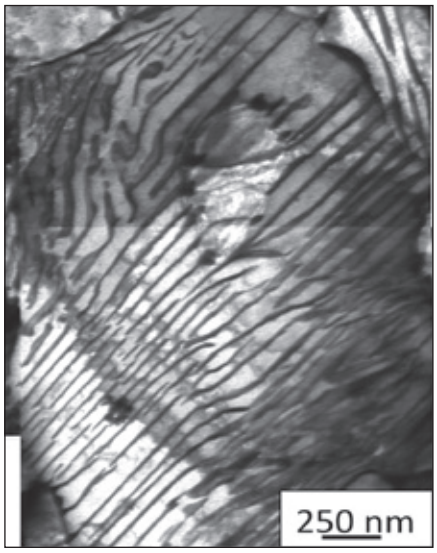
Successivamente è stato effettuato il patentamento in bagni salini con riscaldamento a 980ºC e quindi a 520ºC. Il filo patentato è stato poi ulteriormente trafilato fino a 1mm.

È stata effettuata una prova di trazione in una macchina elettromeccanica ad una velocità costante di deformazione di 5,6 10^{-4}/s, con un estensimetro di 5cm al 50%.

Sono stati testati due campioni in ciascuna condizione. Le deformazioni uniformi sono state definite come deformazione tecnica al carico di picco utilizzato per i calcoli della resistenza massima alla trazione (*UTS - Ultimate Tensile Strength*), e le deformazioni totali a rottura sono state ottenute dalla lettura del valore dell'estensimetro al momento della rottura finale. Tutti i campioni si sono rotti all'interno della lunghezza specifica dell'estensimetro, salvo diversamente specificato.

▼ **Figura 1**: *Micrografie ottiche luminose di barre laminate a caldo in acciaio di base, al boro e ad alto contenuto di boro. Campioni prelevati trasversalmente rispetto alla direzione di laminazione, nel centro della sezione trasversale, incisione 4% Picral*





▲ **Figura 2**: *Micrografo elettronico in trasmissione del materiale ad alto contenuto di B, laminato a caldo e raffreddato*

La caratterizzazione microstrutturale è stata realizzata con microscopia ottica luminosa in campioni incisi con Picral al 4% e mediante microscopia elettronica in trasmissione (TEM) su uno strumento Philips CM120 funzionante a 120kV.

Delle lamine sottili sono state sottoposte a elettropulitura con un pulitore a doppio getto Fischione a 32V a temperatura ambiente, utilizzando una miscela di acido acetico al 95% e acido perclorico al 5%.

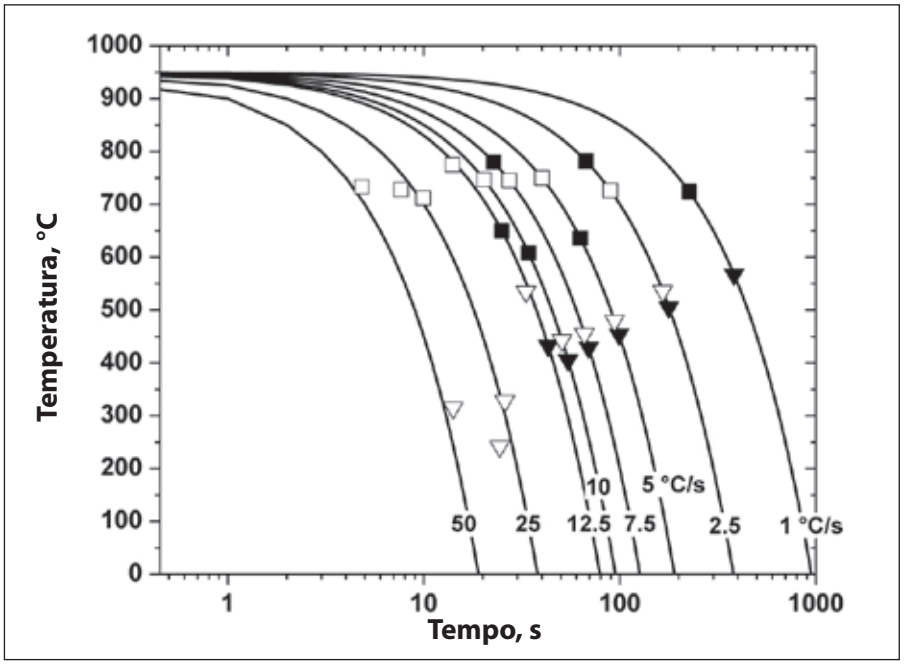
La prova di dilatazione è stata realizzata su un sistema Gleeble® 1500. I campioni sono stati riscaldati a 950°C ad una velocità di riscaldamento costante di 20°C/s e sono stati mantenuti isotermici per cinque minuti. Quindi, l'acciaio è stato raffreddato in gas elio a velocità di raffreddamento costanti programmate rispettivamente di 50, 30, 25, 12, 5, 10, 7, 5, 5, 2, 5 e 1°C/s.

Sono state realizzate delle prove consecutive in un campione singolo per ciascuna lega. La dilatazione del campione è stata monitorata tenendo conto della temperatura e del tempo.

Risultati e discussione

Le micrografie ottiche luminose effettuate a metà della sezione trasversale delle barre laminate a caldo sono illustrate nella *Tabella 1*.

Sono apprezzabili microstrutture perlitiche. Non sono state osservate reti di costituenti proeutettoidi.



▲ **Figura 3**: *Temperature di inizio (quadri) e fine (triangoli) trasformazione per diverse velocità di raffreddamento costante Simboli pieni: lega di base e simboli aperti: acciai al B*

È stata effettuata l'analisi TEM dell'acciaio legato superstechiometricamente per valutare l'effetto del boro libero sull'evoluzione microstrutturale e una micrografia TEM rappresentativa è illustrata sulla *Figura 2*.

Non è stata rilevata presenza di martensite, indicando probabilmente che il boro non aumenta la temprabilità. È noto che il boro aumenta considerevolmente la temprabilità in acciai a basso contenuto di carbonio.[9] Tuttavia, è stato riportato che questo effetto è meno pronunciato in acciai ad alto tenore di carbonio.[10,11]

Al fine di verificare l'effetto della lega sulla temprabilità, è stato effettuata una prova di dilatazione sulla base e sulla lega di boro come discusso nel riferimento 12.

La prova ha dimostrato che la lega di boro determinava una diminuzione della temprabilità come si può vedere sulla *Figura 3*, che indica le temperature di inizio e fine della trasformazione per le leghe di base e di boro ad una temperatura in funzione del diagramma del tempo. Come si può notare, sono state esaminate varie velocità di raffreddamento costante. A velocità di raffreddamento di 25 e 50°C/s, la trasformazione della martensite è stato l'unico meccanismo di decomposizione dell'austenite rilevato nella lega di base, mentre è stata osservata la trasformazione di perlite nell'acciaio al boro. Inoltre, l'acciaio al Boro ha evidenziato un'area più ampia di trasformazione della perlite.

Le curve tensione-deformazione e le proprietà di trazione delle barre laminate a caldo sono indicate nella *Figura 4* e nella *Tabella 2*.

Gli acciai di base e al B evidenziano comportamenti di tensione-deformazione molto simili sebbene l'acciaio al B mostri un allungamento del limite di snervamento (*YPE - Yield Point Elongation*) mentre l'acciaio di base mostra uno snervamento continuo, cioè uniforme (*round-house*).

L'evento dell'allungamento del limite di snervamento può essere piuttosto inaspettato dato che la lega era progettata per tenere l'azoto legato al boro e pertanto l'allungamento del limite di snervamento non dovrebbe essere determinato dall'invecchiamento per deformazione dell'azoto "libero". Di conseguenza, il comportamento si riferisce presumibilmente all'invecchiamento per deformazione del carbonio.

Va notato che le barre sono state raddrizzate a temperatura ambiente in seguito alla laminazione a caldo e, in alcuni casi, una deformazione non uniforme durante la raddrizzatura può aver determinato l'eliminazione dell'allungamento del limite di snervamento.

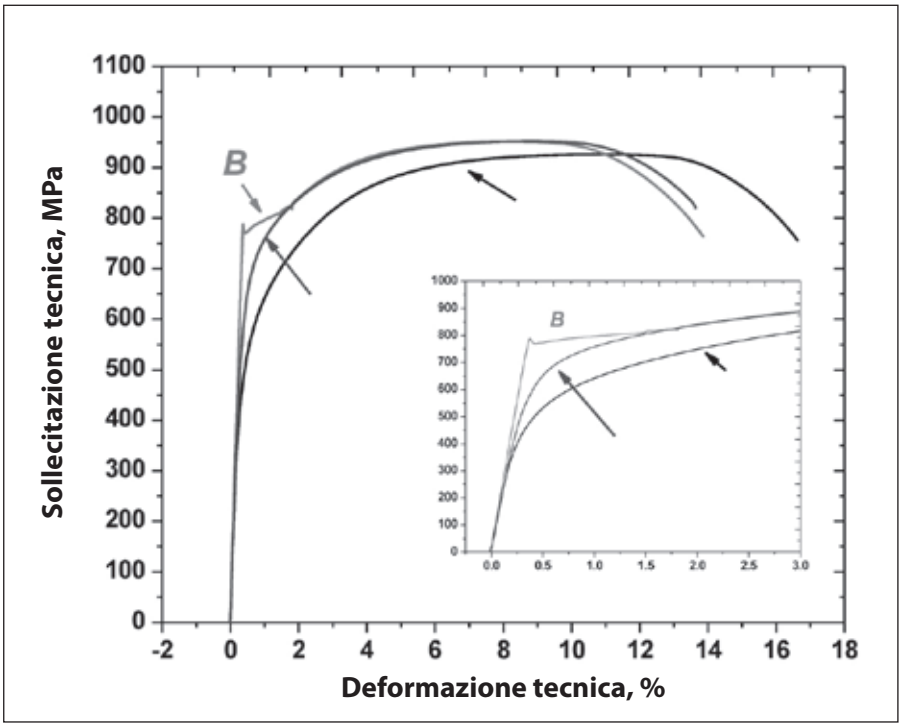
Nell'acciaio di base e al B sono state ottenuti resistenze alla trazione e allungamenti simili.

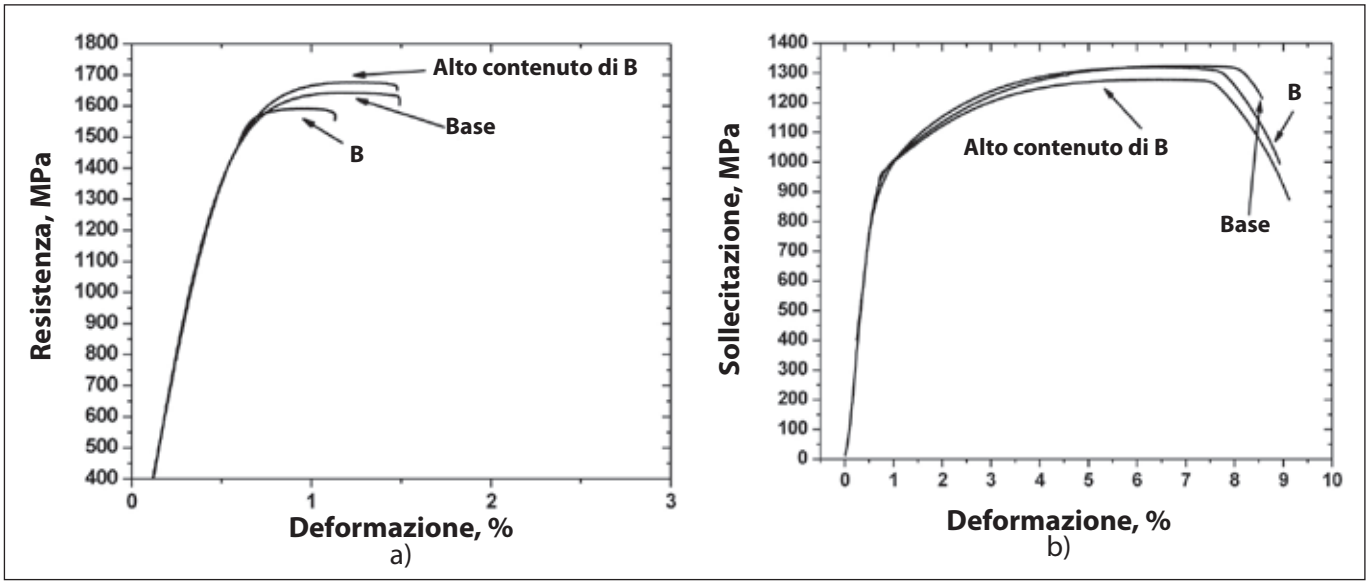
L'acciaio ad alto tenore di B ha evidenziato valori di resistenza più bassi; si può notare uno snervamento uniforme a valori di resistenza inferiori rispetto ad altri acciai ed è stato raggiunto un carico di rottura più basso di circa 25 MPa.

▼ **Tabella 2** – *Proprietà di trazione delle barre laminate a caldo*

	UTS, MPa	UE, %	TE, %
Base	952	9.4	13.7
B	951	8.2	13.9
Alto contenuto di B	926	11.2	16.6

▼ **Figura 4**: *Curve di tensione-deformazione delle barre laminate a caldo*





▲ **Figura 5**: *Curve di tensione-deformazione del filo a) trafilato fino a 2,5mm e b) patentato a 2,5mm*

		UTS, MPa	UE, %	TE, %
Trafilato fino a 2,5mm	Base	1644	1.2	1.5
	B	1592	1.0	1.1
	Alto contenuto di B	1677	1.2	1.5
Patentato a 2,5mm	Base	1324	7.3	8.6
	B	1317	6.7	8.9
	Alto contenuto di B	1277	6.7	9.1

▲ **Tabella 3** – *Proprietà di trazione, carico di rottura (UTS), Allungamento uniforme (UE) e Allungamento totale (TE) dei fili trafilati a 2,5mm e patentati a 2,5mm*

Questa differenza di resistenza non può essere attribuita al carbonio poiché sono stati selezionati campioni con lo stesso tenore di carbonio per le prove.

L'acciaio ad alto tenore di B ha mostrato un allungamento alla trazione più elevato. È interessante notare che una ridotta resistenza alla trazione con lega di boro è in linea con gli studi precedenti su acciai a basso1 e alto7 tenore di carbonio e con una maggiore temprabilità osservata nello studio della dilatometria.

Una maggiore cinetica della trasformazione della perlite può comportare un aumento delle spaziature lamellari e/o perlite a grana più grossa.

Si può anche obiettare che il ridotto livello di resistenza può essere messo in relazione con un ridotto indurimento per soluzione solida. Tuttavia, va notato che la lega di B non evidenzia alcuna diminuzione della resistenza rispetto alla lega di base.

Precedentemente è stato suggerito che la riduzione della resistenza è in relazione ad un effetto legante nella trasformazione da austenite a ferrite1 o perlite11.

Le proprietà meccaniche in seguito alla trafilatura di filo fino a 2,5mm di diametro sono illustrate nella *Figura 5a* e nella *Tabella 3*. Nella condizione di trafilatura, l'acciaio al B evidenzia la resistenza alla trazione e all'allungamento più bassi, e l'acciaio ad alto tenore di B mostra la resistenza alla trazione e l'allungamento più alti rispetto all'acciaio al B.

L'acciaio di base mostra un allungamento uniforme ed un allungamento totale simili rispetto all'acciaio ad alto tenore di B, sebbene ad una resistenza alla trazione inferiore. Va notato che si sono verificati dei guasti nelle maniglie di trazione che hanno probabilmente influenzato i valori di allungamento complessivi.

Le proprietà di trazione ottenute dopo il patentamento a 2,5mm di diametro sono indicati nella *Figura 5b* e nella *Tabella 3*.

Resistenze a trazione similari vengono ottenute nell'acciaio di base e nell'acciaio al B, mentre l'acciaio ad alto tenore di B mostra un carico di rottura inferiore di circa 50MPa. Questa minore resistenza può essere nuovamente messa in relazione con un aumento della cinetica di decomposizione dell'austenite. Un valore di allungamento lievemente superiore si ottiene nei due acciai che contengono boro.

I fili patentati sono stati successivamente trafilati fino a 1mm di diametro con passate consecutive e le proprietà di trazione risultanti, oltre al numero di torsioni fino a rottura (N_t) e al numero di curvature inverse (N_b), sono indicate nella *Tabella 4*.

E' nuovamente evidente una diminuzione della resistenza alla trazione della lega di boro ed un lieve aumento dell'allungamento uniforme e complessivo. Tuttavia, il numero di torsioni fino a rottura non viene alterato dalla lega, mentre si osserva una lieve diminuzione del numero di curvature inverse con livelli di boro maggiori.

Per controllare la risposta all'invecchiamento del filo trafilato a 1mm, è stato effettuato un invecchiamento isotermico a 150°C per un'ora ed i risultati sono illustrati nella *Tabella 5*.

È stato ottenuto un aumento della resistenza alla trazione di circa 170MPa mentre gli allungamenti alla trazione sono stati ridotti allo 0,4% dell'allungamento uniforme e all'1,5% dell'allungamento totale.

▼ **Tabella 4** – *Proprietà di trazione, carico di rottura (UTS), Allungamento uniforme (UE) e Allungamento totale (TE) dei fili trafilati a 1mm dopo il patentamento*

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2106	1.1	2.1	41	12
B	2096	1.3	2.4	42	11
Alto contenuto di B	2087	1.4	2.5	41	9

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2263	0.4	1.5	35	11
B	2283	0.4	1.5	36	10
Alto contenuto di B	2257	0.4	1.5	36	8

▲ **Tabella 5** – *Proprietà di trazione, carico di rottura (UTS), Allungamento uniforme (UE) e Allungamento totale (TE) valutati in seguito ad invecchiamento a 150°C per un'ora dei fili trafilati a 1mm dopo il patentamento*

Allungamenti simili sono stati ottenuti in tutte le leghe. Sono stati ancora osservati valori di torsione fino a rottura simili a quelli dei materiali non sottoposti a invecchiamento in tutte le leghe sebbene a livelli più bassi.

La tendenza ad ottenere un numero inferiore di curvature inverse all'aumentare dei livelli di boro è stata osservata nuovamente in condizioni di invecchiamento ed è stata ottenuta circa una piegatura in meno nella condizione di invecchiamento rispetto alla condizione di non invecchiamento per tutti gli acciai.

Ciò suggerisce che la lega di boro non influenza significativamente la duttilità ai livelli di azoto studiati.

Va notato che i livelli di azoto di circa 40ppm delle colate attuali rappresentano la parte di materiale prodotto industrialmente dalle caratteristiche di qualità inferiore.

Conclusioni

È stato analizzato l'effetto della lega di boro di acciai con 0,80C per legare azoto interstiziale "libero".

Sono state preparate in laboratorio colate con rapporti B:N di 1,4 e 2,4 in aggiunta ad una lega di base senza boro, laminate a caldo, trafilate e patentate e ulteriormente trafilate fino ad un diametro finale di 1mm.

È stata effettuata la caratterizzazione microstrutturale e sono state valutate le proprietà di trazione.

L'effetto limitato della lega di boro sulle proprietà del materiale in filo, in particolare sulla duttilità torsionale, è stato evidente ai livelli di azoto studiati.

È stato osservato un carico di rottura inferiore nell'acciaio ad alto tenore di B. ■

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Dätwyler realiza el cableado del nuevo centro de datos de la Asociación Regional de Renania

CON vistas a racionalizar sus operaciones, LVR-InfoKom, la casa de sistemas de la LVR, Asociación Regional de Renania, ha ampliado su principal centro de datos de Colonia, en Alemania, y lo ha trasladado a un nuevo edificio. El contrato para el nuevo cableado fue adjudicado a Datwyler, que ofreció una solución general económica y un plazo de finalización breve.

En 2009 LVR-InfoKom decidió ampliar uno de sus dos centros de datos y trasladarlo a un nuevo edificio que, además de la sala del servidor, también dispone de una serie de salas funcionales. En el nuevo centro de datos todos los componentes activos debían ir interconectados mediante un sistema de cableado preparado para el futuro y de conexión directa punto a punto (*top-of-rack*).

▲ *Nuevo centro de datos cableado por Datwyler*

Por lo tanto, para el sector de la tecnología de cobre sacó a concurso un sistema de clase EA con una capacidad de 10 giga bits. Para el sector de la fibra óptica la LVR quería cable multimodo OM3 y para el enlace con el exterior cables monomodo OS2 en montaje de fibra entubada, que debían suministrarse completos con *splitters* y conectores LCD premontados.

Además de las medidas de aceptación y el ensayo funcional del cableado, para el sistema se requería una garantía de 20 años más un juego completo de documentación, que también tenía que incluir el enlace de los componentes activos. Asimismo, el amplio proyecto del cableado debía incluir la construcción del tendido del cableado, la instalación de cortafuegos entre las salas funcionales y el alojamiento del tendido de cable por los pasillos.

El planteamiento de Datwyler para ejecutar el pedido fue aplicar una estrategia llave en mano. En tan sólo unos días, los equipos de Datwyler fueron capaces de instalar los cables de cobre tipo 7702, ensamblarlos con conectores y, por último, medir y documentar los segmentos de línea, unos 1000 con una longitud total de 16 kilómetros. Los cables de enlace FO premontados (cables múltiples), un total de 210 líneas, en la mayoría de los casos de 24 fibras cada una, fueron llegando junto con los informes de los ensayos en una serie de entregas y se fueron instalando inmediatamente a medida que iban llegando.

Otros 1500 cables de interconexión de fibra óptica y cobre, 400 paneles de interconexión y bahías de interconexión, así como unas 200 placas de distribución ópticas forman parte del sistema.

Datwyler – Alemania
Website: www.datwyler.com

Invirtiendo en dinamizar la producción

La sociedad inglesa Hutchinson Engineering de Widnes, en Cheshire, ha decidido invertir más de 500.000 libras esterlinas en nueva tecnología para dinamizar su producción de torres de telefonía móvil y estructuras para turbinas eólicas.

El nuevo equipo Ficep, constituido por una Gemini de fabricación italiana diseñada para taladrar, roscar, fresar, marcar y cortar acero en caliente y adquirida por 370.000 libras, y una PC600 de fabricación holandesa para el corte térmico biselado de tubos que ha costado 140.000 libras, agilizará las operaciones de fabricación y el proceso de corte generando piezas de calidad que encajen mejor y acorten los tiempos de soldadura.

Esta nueva maquinaria permitirá a la empresa fabricar turbinas eólicas de mayores dimensiones, de 50KW y 100KW, con más facilidad. Asimismo, acortará los tiempos de fabricación y entrega de las placas de soporte de las torres de telecomunicaciones, diseñadas para O2 y Vodafone.

Hutchinson Engineering – Reino Unido
Website: www.hutchinson-engineering.co.uk

Tecnología ADN para combatir el robo de metales

UN revolucionario sistema de alarma portátil capaz de grabar a ladrones en acción y relacionarlos con delitos mediante uso de tecnología ADN en puntos remotos ha sido aclamado por la policía como un paso importante para ayudar a combatir un aumento masivo del robo de metales.

El sistema AATTS (*Alarmed and Traceable Technology Solutions System*), desarrollado por la escocesa PID Systems de Kilmarnock, es el primer sistema de alarma construido con el objetivo de proteger propiedades y lugares vulnerables aprobado y recomendado por la Asociación de Jefes de Policía (ACPO).

Es un sistema inalámbrico que, por consiguiente, no necesita estar conectado a ninguna red de alimentación y puede ser instalado de manera rápida y fácil. Además de sonar cuando detecta un intruso, envía una señal al propietario del local, a PID Systems y graba en vídeo cualquier intento de robo.

El dispositivo antirrobo utiliza además un tinte rojo ultravioleta indeleble, que sólo puede verse con luz ultravioleta. Pulveriza sobre los intrusos un agente de marcación molecular encriptada que puede ser asociado a la escena del crimen.

Jacqui Shiel, director de desarrollo de la iniciativa *Secured by Design* de la Asociación de Jefes de Policía dijo: "El robo de metales se está convirtiendo en un problema cada vez mayor que puede resultar muy caro de resolver, tanto por el coste de los materiales de reposición como por el de las reparaciones de los daños causados. La alarma inmediata de cualquier posible incidente es fundamental para evitar esta intrusión e identificar a los culpables."

Se ha observado un aumento consistente en el robo de metales, causado por la subida del coste global. El precio del cobre pasó de 889£/t en noviembre de 2001 a 6.356£/t el año pasado. De acuerdo con el departamento HMRC (*Her Majesty's Revenue and Customs*), una cantidad estimada en 10.000 casos de robo de metales al año cuesta a la economía británica más de 5.600 millones de libras en pérdidas de ingresos.

Entre los casos de robo de cobre más importantes está el caso de Network Rail, que entre 2009 y 2010 vio aumentar los robos de cables de las líneas ferroviarias en un 65%, lo cual supuso una pérdida de 16.000 horas de trabajo, y el de BT que vio aumentar los casos de robo de cables en un 12% el año pasado.

Graham Jones, miembro del parlamento por Hyndburn, ha presentado en la Cámara de los Comunes una propuesta de ley para prevenir el robo de metales en un esfuerzo por incrementar la trazabilidad en el sector de la chatarra, que comprende un riguroso régimen de autorización para los depósitos de chatarra. En Escocia se va a introducir una ley separada.

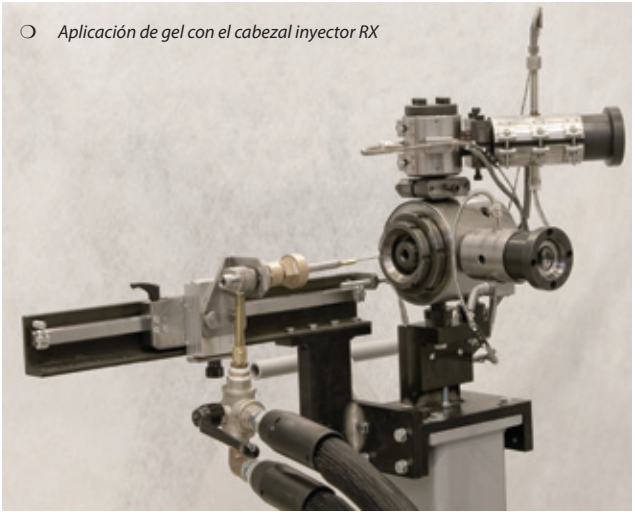
PID Systems – Reino Unido
Website: www.pid-systems.co.uk

Rosendahl responde a la demanda

El principio de los cables de fibra óptica rellenos de gel sigue acaparando un importante porcentaje en el mercado de los cables de fibra óptica. Los cabezales inyectores serie RX de Rosendahl responden a esta demanda con un sistema opcional de inyección de gel modular con agujas fáciles de cambiar y regular, montado en un sistema de guía lineal de alta precisión.

La inyección continua de gel tixotrópico y el perfecto equilibrio del flujo polimérico por el distribuidor del cabezal inyector RX garantizan una salida del compuesto para cables de fibra óptica estable y sin problemas.

Los cabezales inyectores RX de Rosendahl se caracterizan por una alta precisión en el centrado, lo cual evita cualquier sobredimensionamiento del espesor de la pared del cable, ahorrando así en material y en costes de producción. La forma perfeccionada del canal de flujo se ajusta a la reología de los materiales de revestimiento especiales, garantiza tiempos cortos de permanencia del polímero fundido y permite cambiar de color o de material de manera rápida y fácil. Su diseño compacto y modular, unido al cómodo centrado de precisión, garantizan su facilidad de manejo.



❍ *Aplicación de gel con el cabezal inyector RX*

El diseño del cabezal RX de Rosendahl evita desviaciones en el proceso y permite mejorar la calidad y eficiencia de sus líneas de extrusión de cables de fibra óptica rellenos de gel.

Rosendahl – Austria
Website: www.rosendahlaustria.com

Efecto de la aleación de boro en la evolución microestructural y las propiedades mecánicas del alambre de alto contenido de carbono

Por Emmanuel De Moor, Advanced Steel Processing and Products Research Centre, y Walther Van Raemdonck, NV Bekaert SA

Resumen

La aleación de boro se usa frecuentemente en el acero de bajo contenido de carbono para enlazar el nitrógeno libre y evitar el envejecimiento por deformación mejorando la ductilidad (torsional) de los productos de alambre.

Este estudio analiza los efectos de la aleación de boro en acero de alto contenido de carbono (0,80 pct en peso). Se prepararon coladas de laboratorio con relaciones boro-nitrógeno de 1:1 y 2:1, además de una colada de referencia.

El material fue laminado en caliente, trefilado, patentado y luego trefilado de nuevo hasta 1mm.

Las propiedades mecánicas y la caracterización microestructural fueron verificadas en cada etapa intermedia.

Los efectos limitados de la aleación de boro en las propiedades mecánicas fueron evidentes.

Introducción

Los hornos de arco eléctrico son utilizados cada vez más, especialmente en Norteamérica, para la producción de acero de productos largos. La sustitución del acero efervescente por acero producido en coladas continuas con hornos de arco eléctrico (EAF) se encuentra ante determinados desafíos para cumplir los requisitos de calidad del producto, en particular, por lo que se refiere a la ductilidad (torsional).

Esto está relacionado con el contenido de nitrógeno intrínsecamente más elevado del acero producido en un horno EAF. Si el nitrógeno se difunde, puede causar envejecimiento por deformación que lleva a un mayor endurecimiento por acritud y una menor ductilidad del producto de alambre.[1]

Se han realizado trabajos de investigación importantes para reducir el contenido de nitrógeno libre de las calidades de alambrón con bajo contenido de carbono mediante aleaciones realizadas con microadiciones, por ejemplo, de boro, vanadio o niobio.[1-6] La aleación de boro del acero con alto contenido de carbono ha sido tratada menos hasta ahora[7] y es el tema en que nos vamos a centrar en este estudio.

Procedimiento Experimental

El boro se puede combinar con el nitrógeno para formar nitruro de boro como se indica en la fórmula

$$B + N = BN \qquad (1)$$

y su estequiometría corresponde a una relación B:N de 11:14 ó 0,79, dado el peso atómico del boro y del nitrógeno.

Para este estudio se prepararon tres aleaciones con contenido de carbono de 0,80 pct en peso con el fin de tener una aleación de referencia,

▼ **Tabla 1** – *Composición química en pct de peso de los aceros preparados en el laboratorio*

	C	Mn	Si	Cr	B, ppm	N, ppm
Base	0.78	0.48	0.25	0.20	-	42
B	0.82	0.46	0.23	0.20	62	43
Alto contenido de B	0.76	0.47	0.23	0.20	98	41

una aleación de boro y nitrógeno en relación estequiométrica y una aleación superestequiométrica con relación B:N de 2:1. Este último acero permite estudiar el efecto del boro "libre" adicional en el desarrollo microestructural y las propiedades microestructurales.

La *Tabla 1* muestra la composición de las barras preparadas en el laboratorio; nótese que las relaciones de las composiciones en estado bruto de colada (*"as-cast"*) eran un poco más altas de preparadas en laboratorio, en concreto 1,44 y 2,39 respectivamente en las aleaciones de B y con alto contenido de B. Por lo tanto, la aleación de B también puede contener boro libre.

Las barras fueron laminadas en caliente en un laminador cargado a mano a una temperatura de 1176°C y la reducción fue realizada en tres etapas en dos laminadores en caliente.

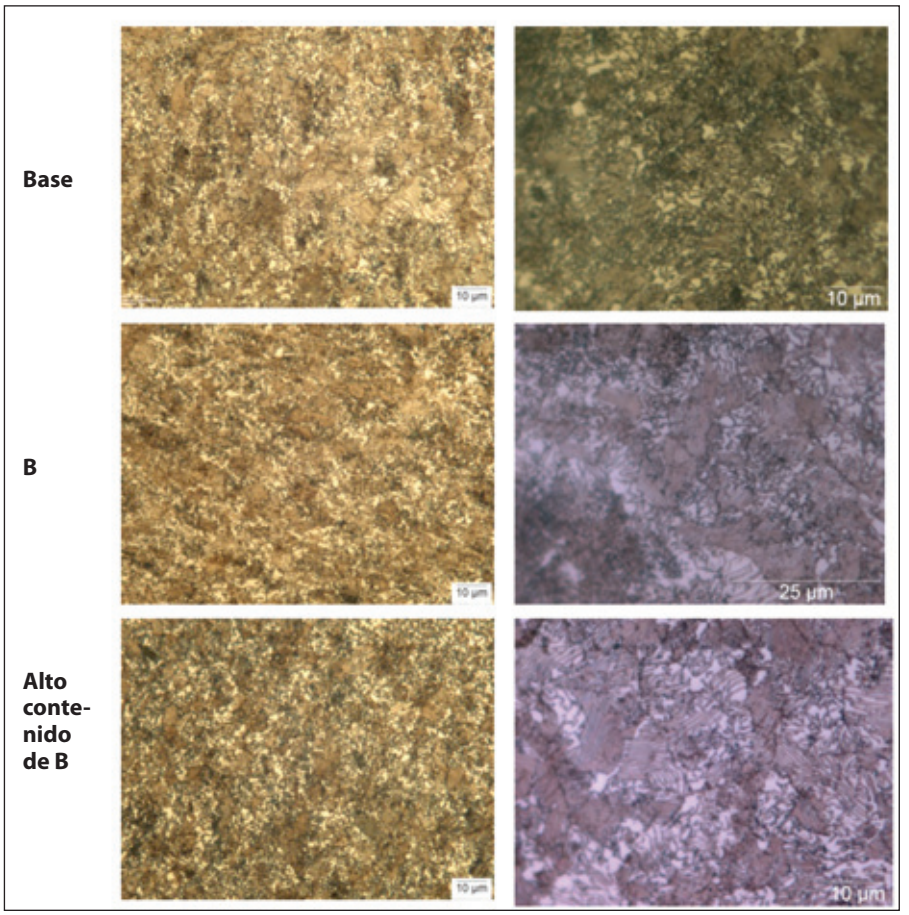
Inicialmente, las barras fueron reducidas de 12,7 a 9,5cm, obteniéndose barras cuadradas de aristas redondeadas (*RCS - Round Corner Square*), que luego fueron enfriadas con aire a la temperatura ambiente, recalentadas y laminadas hasta 4,76cm. Sucesivamente, el material fue mecanizado para eliminar los óxidos y cortado en 6-7 trozos. La reducción final fue realizada en un segundo laminador en caliente hasta el tamaño final de 7,1mm.

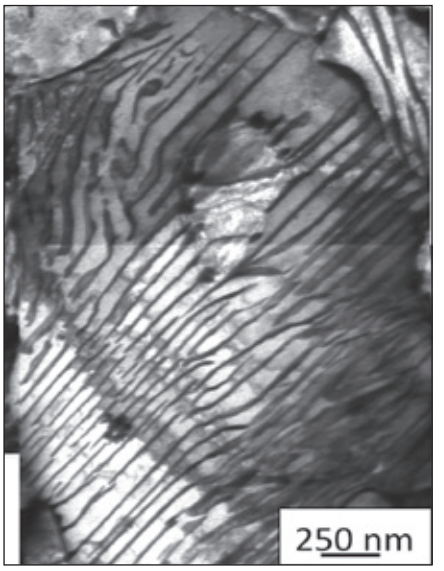
Después de la laminación en caliente, se enfrió el material con aire a la temperatura ambiente. Luego, el material fue cortado con sierra en piezas de 3,7m, antes de ser trefilado. Se obtuvieron veinticuatro secciones de cada aleación. Aunque los cálculos termodinámicos obtenidos mediante el programa Thermo-Calc® preveían una posible fragilidad en caliente del acero con alto contenido de B, no se observaron roturas ni defectos superficiales significativos.

Dado que se había notado una descarburización significativa,[8] el material fue sometido a rectificado sin centros hasta un diámetro de 5,5mm. Luego, se analizó si las varillas laminadas en caliente presentaban o no segregación de carbono y se seleccionaron solamente las varillas con contenido de carbono de 0,78 ± 0,01 pct de peso para el trefilado de alambre sucesivo.

Se efectuó el trefilado de alambre en el Bekaert Technology Centre aplicando una reducción a 2,5mm de diámetro en ocho pasos de trefilado. Sucesivamente, se efectuó el patentado en baños de sales

▼ **Figura 1**: *Micrografías ópticas de luz de las varillas laminadas en caliente de acero de base, al B y con alto contenido de B. Muestras tomadas en sentido transversal al de laminación, en el centro de la sección, ataque con Picral al 4%*





▲ **Figura 2**: *Micrografía electrónica de transmisión del material con alto contenido de B laminado en caliente y enfriado con aire*

a una temperatura de 980ºC seguida de 520ºC. Luego, el alambre patentado fue trefilado de nuevo hasta 1mm.

Se efectuaron ensayos de tracción en una máquina electromecánica a una velocidad de deformación constante de 5,6 10^{-4} /s, con un extensómetro de 5cm al 50%. Se probaron dos muestras en cada condición.

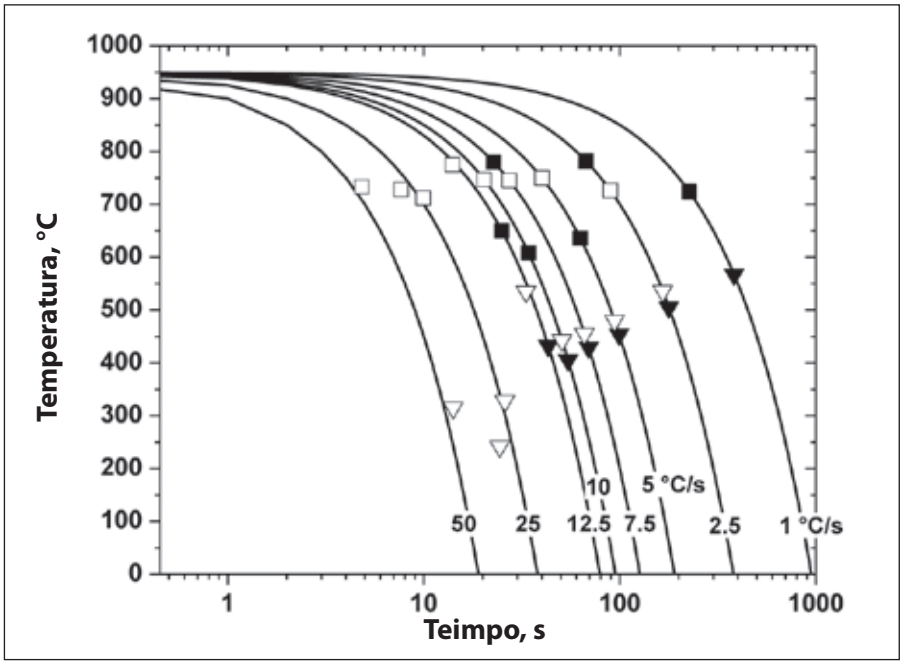
Se determinaron las deformaciones uniformes como deformación ingenieril a la carga de pico usada para los cálculos del límite de resistencia a la tracción (*UTS - Ultimate Tensile Strength*), y las deformaciones a rotura totales fueron obtenidas de la lectura del valor del extensómetro en el momento de la fractura final. Todas las muestras se rompieron dentro de la longitud específica del extensómetro salvo donde se indique lo contrario.

La caracterización microestructural fue realizada con microscopía óptica de luz en muestras atacadas químicamente con Picral al 4% y con microscopía electrónica de transmisión (*TEM*) en un instrumento Philips CM120 a 120kV.

Las láminas finas fueron electropulidas con un equipo para el pulido electrolítico de dos chorros de Fischione a 32V a temperatura ambiente, usando una mezcla de 95 pct de ácido acético y 5 pct de ácido perclórico.

El estudio de dilatometría fue realizado en un sistema Gleeble® 1500. Las muestras fueron calentadas a 950°C a una velocidad de calentamiento constante de 20°C/s y fueron mantenidas isotérmicas durante cinco minutos.

Luego, el acero fue enfriado en helio a velocidades de enfriamiento constante



▲ **Figura 3**: *Temperatura inicial (cuadrados) y final (triángulos) a distintas velocidades de enfriamiento constante. Símbolos llenos: aleación de base y símbolos vacíos: acero al B*

programado respectivamente de 50, 30, 25, 12,5, 10, 7,5, 5, 2,5 y 1°C/s. Se realizaron ensayos consecutivos en una muestra de cada aleación. La dilatación de la muestra fue monitorizada en función de la temperatura y del tiempo.

Resultados y Discusión

Las micrografías ópticas de luz tomadas en el centro de la sección de las varillas laminadas en caliente se pueden ver en la *Figura 1*. Resultan evidentes algunas microestructuras perlíticas. No se encontraron redes de constituyentes proeutectoides.

Se efectuó el análisis con microscopía electrónica de transmisión (*TEM*) del acero aleado superestequiométricamente para evaluar el efecto del boro libre en la evolución microestructural y en la *Figura 2* se muestra una micrografía TEM representativa. No se detectó martensita, lo que quizás indique que el boro libre no aumentó la templabilidad.

Se sabe que el boro aumenta fuertemente la templabilidad en aceros de bajo carbono.[9] De todos modos, este efecto es más leve en aceros de alto carbono.[10,11] Para verificar el efecto de la aleación en la templabilidad se efectuó un estudio de dilatometría en la aleación de base y en la aleación de B como se comentó anteriormente en 12.

El ensayo demostró que la aleación de boro bajaba la templabilidad, como se puede ver en la *Figura 3*, donde se indican las temperaturas de inicio y fin de la transformación de la aleación de base y la aleación de B en un gráfico de la temperatura en función del tiempo. Como se puede ver, se examinaron varias velocidades de enfriamiento constantes.

A velocidades de enfriamiento de 25ºC/s y 50ºC/s, la transformación de la martensita fue el único mecanismo de descomposición de la austenita detectado en la aleación de base, mientras que en el acero al boro la perlita sufrió una transformación.

Además, en el acero al B se observó una zona de transformación de la perlita más amplia.

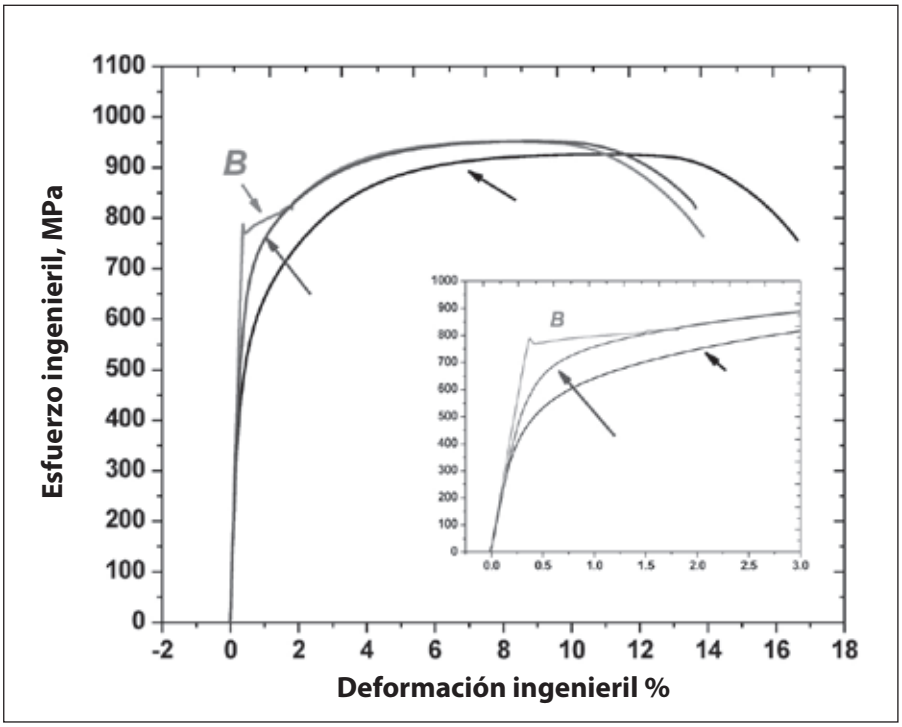
Las curvas de esfuerzo-deformación y las propiedades de tracción de las varillas laminadas en caliente están indicadas en la *Figura 4* y la *Tabla 2*. Los aceros de base y al B muestran comportamientos de esfuerzo-deformación muy similares, aunque en el acero al B se observa alargamiento en el punto de fluencia (*YPE - Yield Point Elongation*), y en el acero de base se observa una deformación continua, es decir, uniforme (*round-house*).

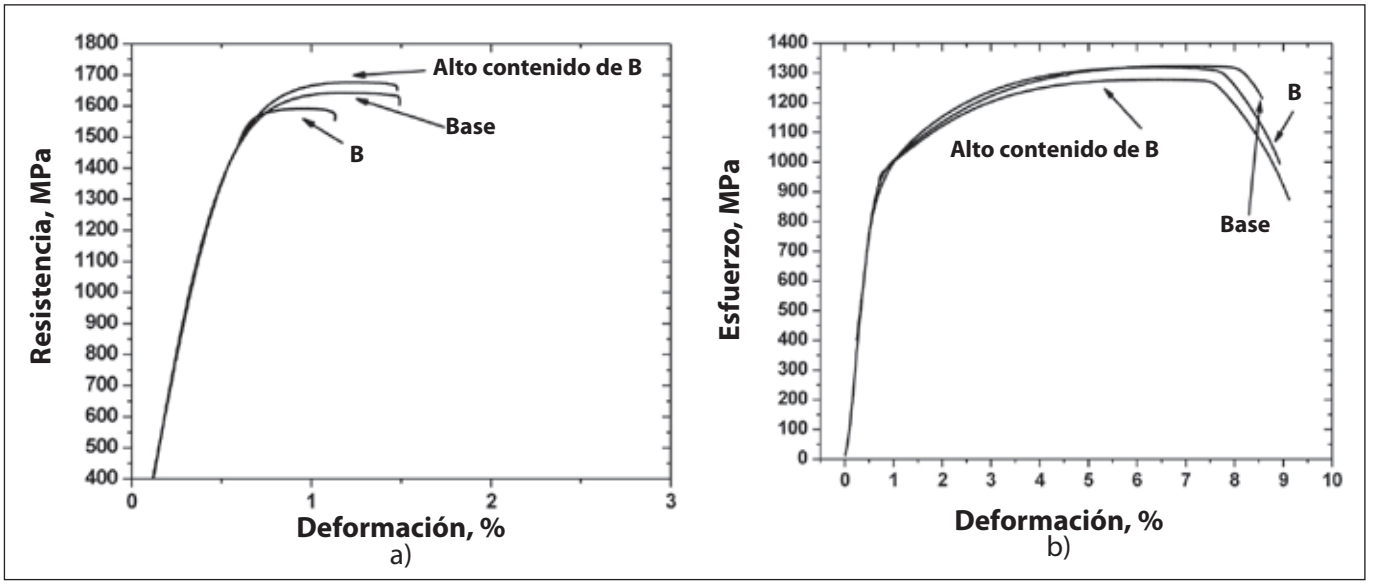
La ocurrencia de alargamiento en el punto de fluencia puede ser algo inesperada dado que la aleación había sido diseñada para tener nitrógeno enlazado al boro y por lo tanto el alargamiento en el punto de fluencia no debería resultar del envejecimiento por deformación del nitrógeno "libre". Por consiguiente, el comportamiento se relaciona con el

▼ **Tabla 2** – *Propiedades de tracción de las varillas laminadas en caliente*

	UTS, MPa	UE, %	TE, %
Base	952	9.4	13.7
B	951	8.2	13.9
Alto contenido de B	926	11.2	16.6

▼ **Figura 4**: *Curvas de esfuerzo-deformación de las varillas laminadas en caliente*





▲ **Figura 5**: *Curvas de esfuerzo-deformación del alambre a) trefilado hasta 2,5mm y b) patentado hasta 2,5mm*

		UTS, MPa	UE, %	TE, %
Trefilado hasta 2,5mm	Base	1644	1.2	1.5
	B	1592	1.0	1.1
	Alto contenido de B	1677	1.2	1.5
Patentado hasta 2,5mm	Base	1324	7.3	8.6
	B	1317	6.7	8.9
	Alto contenido de B	1277	6.7	9.1

▲ **Tabla 3** – *Propiedades de tracción: límite de resistencia a tracción (UTS), alargamiento uniforme (UE) y alargamiento total (TE) del alambre trefilado hasta 2,5mm y patentado hasta 2,5mm*

envejecimiento por deformación del carbono. Se debe reconocer que se habían enderezado las varillas a temperatura ambiente después de la laminación en caliente, y una deformación no uniforme durante el enderezamiento puede haber llevado a la eliminación del alargamiento en el punto de fluencia en algunos casos. En el acero de base y al B se obtuvieron resistencias a la tracción y alargamientos similares.

El acero de alto contenido de B dio valores de resistencia más bajos; se puede notar deformación uniforme a valores de resistencia más bajos respecto a los otros aceros y se obtuvo un límite de resistencia a la tracción más bajo de aproximadamente 25 NPa.

Esta diferencia de resistencia no se puede atribuir al carbono, dado que para los ensayos se seleccionaron muestras con el mismo contenido de carbono.

El acero con alto contenido de B dio un alargamiento a la tracción más alto. Es interesante notar que la baja resistencia a la tracción del acero aleado con boro es concorde con los resultados de los trabajos anteriores sobre aceros con bajo[1] y alto[7] contenido de carbono y es concorde también con la mayor templabilidad observada en el estudio de dilatometría. La cinética de una mayor transformación de la perlita puede llevar a un aumento del espaciado entre láminas o a una perlita de grano más grueso.

Se puede replicar que el bajo nivel de resistencia puede estar relacionado con un menor endurecimiento por solución sólida.

Sin embargo, se debe reconocer que la aleación de B no presenta una reducción de resistencia respecto a la aleación de base. Se ha indicado anteriormente que la reducción de resistencia está relacionada con un efecto de la aleación en la transformación de la austenita en ferrita[1] o perlita[11].

Las propiedades mecánicas después del trefilado de alambre a 2,5mm de diámetro están ilustradas en la *Figura 5a* y en la *Tabla 3*.

En las condiciones de trefilado, el acero al B ofrece la resistencia a la tracción y el alargamiento más bajos, el acero con alto contenido de B ofrece la resistencia a la tracción más alta y mayor alargamiento respecto al acero al B.

El acero de base presenta un alargamiento uniforme y un alargamiento total similares respecto al acero de alto contenido de B, aunque con una resistencia a la tracción más baja.

Se debe reconocer que ocurrieron fallos en las mordazas de tracción que probablemente pueden influenciar los valores de alargamiento total.

Las propiedades de tracción obtenidas después del patentado a 2,5mm de diámetro están indicadas en la *Figura 5b* y en la *Tabla 3*.

En el acero de base y el acero al B se obtienen resistencias de tracción similares, mientras que el acero con alto contenido de B presenta un límite de resistencia a la tracción inferior a aproximadamente 50MPa. Esta menor resistencia puede estar de nuevo relacionada con un aumento de la cinética de descomposición de la austenita. En los dos aceros que contienen boro se obtiene un valor de alargamiento total un poco más alto.

Los alambres patentados fueron trefilados sucesivamente hasta 1mm de diámetro dando pasadas consecutivas.

▼ **Tabla 4** – *Propiedades de tracción: límite de resistencia a tracción (UTS), alargamiento uniforme (UE) y alargamiento total (TE) de los alambres trefilados hasta 1mm después del patentado*

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2106	1.1	2.1	41	12
B	2096	1.3	2.4	42	11
Alto contenido de B	2087	1.4	2.5	41	9

	UTS, MPa	UE, %	TE, %	Nt	Nb
Base	2263	0.4	1.5	35	11
B	2283	0.4	1.5	36	10
Alto contenido de B	2257	0.4	1.5	36	8

▲ **Tabla 5** – *Propiedades de tracción: límite de resistencia a tracción (UTS), alargamiento uniforme (UE) y alargamiento total (TE) verificadas después de someter los alambres trefilados hasta 1mm a un proceso de envejecimiento a 150 ºC durante una hora tras el patentado*

Las propiedades de tracción resultantes, además del número de torsiones a rotura (N_t) y del número de doblados invertidos (N_b), están indicadas en la *Tabla 4*.

Resulta de nuevo evidente en la aleación de boro menor resistencia a la tracción, además de un ligero aumento del alargamiento uniforme y total.

De todos modos, el número de torsiones a rotura no es alterado por la aleación, mientras que se puede observar una ligera disminución del número de doblados invertidos al aumentar los niveles de boro. Para controlar la respuesta al envejecimiento del alambre trefilado a 1mm, se sometió la muestra a envejecimiento isotérmico a 150ºC durante una hora cuyos resultados están ilustrados en la *Tabla 5*.

Se obtuvo un aumento de la resistencia a tracción de aproximadamente 170MPa, mientras que los alargamientos a tracción fueron reducidos a un 0,4% del alargamiento uniforme y 1,5% del alargamiento total. En todas las aleaciones se obtuvieron alargamientos similares. Se observaron de nuevo valores de torsión a rotura similares a los del material no envejecido en todas las aleaciones, aunque a niveles más bajos.

La tendencia a obtener menor número de doblados invertidos al aumentar los niveles de boro fue observada de nuevo en condiciones de envejecimiento y se obtuvo aproximadamente un doblado menos en la condición de envejecimiento respecto a la condición de no envejecimiento en todos los aceros.

Esto indica que la aleación de boro no afecta significativamente a la ductilidad a los niveles de nitrógeno analizados. Nótese que los niveles de nitrógeno de las coladas corrientes de aproximadamente 40ppm se refieren al material producido de baja calidad.

Conclusiones

En este estudio hemos analizado el efecto de la aleación de boro en aceros de 0,80C con el objeto de enlazar nitrógeno intersticial "libre". Hemos preparado en el laboratorio coladas con relaciones B:N de 1,4 y 2,4 además de una aleación de base sin boro, que fueron laminadas en caliente, trefiladas y patentadas y luego trefiladas de nuevo hasta un diámetro final de 1mm. Hemos efectuado la caracterización microestructural y comprobado las propiedades de tracción. El efecto limitado de la aleación de boro en las propiedades del alambre, en particular ,en la ductilidad torsional, ha sido evidente, a los niveles de nitrógeno aplicados. Hemos observado un límite de resistencia a la tracción bajo en el acero con alto contenido de B. ■

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editorial index

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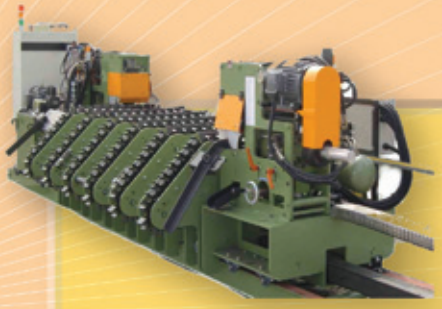

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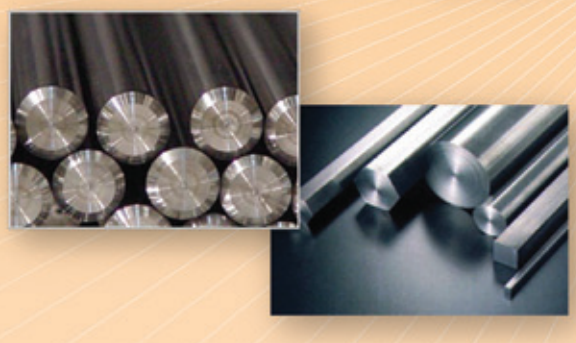

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