Contents

04 Borealis – your experienced PE-Xa partner
05 The benefits of PE-Xa pipe
06 Recent developments in PE-Xa pipe production
07 PE-Xa - the smart investment over time
08 Tailored solutions for PE-Xa pipe production
For decades Borealis has been a major supplier of crosslinkable polyethylene (PE-X) for both Pipe and Wire & Cable applications serving customers around the world with high quality products. Our global network of customers, co-operations and industry key contacts inspire us to devise new developments and ideas.

The Borealis PE-Xa product range is tailored for the production of plumbing and heating pipes and covers two methods of producing PE-X:

- Peroxide crosslinkable (PE-Xa)
- Irradiation crosslinkable (PE-Xc)

Borealis offers much more than PE-Xa solutions. Our dedicated technical support team and the experience built up over more than 20 years are part of our long-term commitment to service in this demanding industry. Continuous product innovation through our passionate Research and Development organisation ensures future competitiveness for our customers.

More Safety and Comfort with Cross-linking

- Flexibility
- Increased heat resistance
- High impact resistance at very low temperatures
- Fast and easy installation
- Increased creep resistance under load and temperature
- Increased chemical resistance
- Very high notch resistance
- Memory effect
- Chlorine resistance
- Abrasion resistance

Since its introduction, peroxide crosslinked PE pipe has been recognised as the preferred choice of an ever increasing number of designers, installers and end-users. Its popularity stems from the outstanding combination of strength, flexibility and the general quality appearance of PE-Xa materials. Today the track record includes more than 30 years of proven success.

Peroxide crosslinked PE pipe is the most flexible type of all PE-X pipes since the crosslinking reaction takes place in the pipe forming process in the molten stage rather than in the pipe post-treatment step.

PE-Xa pipes enjoy good recognition worldwide in a broad variety of applications such as heating and plumbing, gas and domestic water supply, geothermal applications and district heating, as well as in medical and industrial applications.
PE-Xa pipe production typically requires three separate components:

- PE resin
- Peroxide
- Additive package

PE-Xa pipe manufacturers purchase their polyethylene resin, peroxide and additives directly from the producers. The components are dry mixed into a homogeneous mixture. The peroxide is then allowed to soak into the PE over time. Finally, in one step, pipe is extruded and crosslinked.

**Twin-screw and infrared in PE-Xa**

Over the last decade, twin-screw extrusion together with infrared heating has widely become the benchmark production concept in PE-Xa.

This established production technology concept offers vastly increased output compared to conventional PE-Xa production rates in combination with outstanding quality control. Furthermore, at the end of the line, pipe producers will have a ready-crosslinked pipe with no additional steps required. Borealis can offer tailored solutions for your twin-screw and infrared processing production line.

**Recent developments in PE-Xa pipe production**

**PE-Xa - the smart investment over time**

**Top 5 reasons for your PE-Xa investment**

- Inline crosslinking with no post treatment necessary
- Increased line speed now possible with new infrared and twin-screw technology
- PE-Xa now accessible to all thanks to turn-key solutions on the market
- Possibility to diversify with quality on the market with crosslinking
- Favourable economics over the investment period vs. other line concepts

The linespeeds mentioned in the above graph are only indicative and are no guarantee of the actual performance.

*Picture courtesy of Maincor*

*Picture courtesy of Krauss-Maffei*
Borealis HE1878
For decades Borealis and Borouge have served the PEX pipe industry with tailored Borealis polyethylene products best suited for specific production methods. Many recognise our resin, Borealis HE1878, as the top choice for the so-called Engel process. Why? Because Borealis HE1878 was specifically designed in the 1970s for the RAM extrusion process, which was invented by Professor Thomas Engel. Characterised by a high molecular weight and Melt Flow Rate (MFR), the resin still remains the perfect choice for the RAM extruder. Borealis HE1878 is arguably the most used PE resin in PE-X pipe history.

Borealis HE1878E
Over time, screw extruder technology development and high output demand triggered the birth of a new PE resin, Borealis HE1878E. Twin-screw extruders have become the preferred process method for producing PE-Xa pipe due to their ability to offer superior mixing and safe homogenisation without overheating and prematurely crosslinking PE-Xa formulations. All of this contributes to higher production line speeds and longer trouble-free PE-Xa pipe production runs.

Borealis HE1878E was specifically designed to be the high-speed solution for machinery set-ups such as twin-screw extrusion equipment combined with infrared crosslinking technology. Now regarded as a benchmark in the PE-Xa industry, Borealis HE1878E offers a well-balanced molecular weight and higher MFR than traditional PE-Xa resins, as well as a combination of significant advantages: Borealis HE1878E was developed as a result of our dialogue with pipe designers, manufacturers and pipe end-users, listening to market demands. Pipe producers can trust Borealis HE1878E to be the high-performance PE resin for the future.

Borealis HE2591
Borealis HE2591 is the solution for pipe producers wishing to target maximum pipe flexibility. With this unique resin, the pipe producer can effectively balance flexibility with hydrostatic performance. From the processing point of view, Borealis HE2591 provides the same advantages as Borealis HE1878E. It is a true high-speed performer, especially when used in screw extruders.

Borealis HE1878E-C2: Setting a new level of performance with Class 5 listing (NSF)
Borealis HE1878E-C2 was developed to meet the higher requirements of resistance to disinfectants in hot and cold water pipe applications, thereby providing end-users with additional peace of mind. The target was to make a ready-made compound which would meet the highest standards whilst also making PE-Xa pipe production easier, safer and more cost efficient. Tailored for PE-Xa, Borealis HE1878E-C2 has already been established on the market as a leading high performance, cost saving and safe material solution for crosslinked pipes in plumbing applications. Borealis HE1878E-C2 has now further been accredited with the highest available chlorine resistance requirements, Class 5 listing, according to the ASTM F876 standard for PE crosslinked pipes. This accreditation not only confirms the competitive edge of Borealis HE1878E-C2 but also considerably broadens its potential markets, bringing greater benefits to pipe producers and the whole pipe value chain.

In addition to the well-known benefits associated with PE-Xa pipe, such as high temperature resistance, excellent flexibility and low creep, the Borealis HE1878E-C2 solution offers a fundamental production advantage; it is a fully formulated, minipelletised compound that requires only peroxide to be added. Furthermore, its state-of-the-art stabilisation package also opens it up for use in certain industrial applications.

Borealis HE1878E-C2: Tailored for PE-Xa (twin screw)
• Class 5 listing (NSF)
• Fully stabilised – only peroxide to be added
• Best in class stabilisation
• Mini pellets solution
• Material tested in accordance with ASTM F876 and F2023
• Material listed at NSF and PPI

<table>
<thead>
<tr>
<th>Borealis HE1878E-C2</th>
<th>MFR 190°C/21.6 kg (g/10 min)</th>
<th>Density (kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borealis HE1878E</td>
<td>10</td>
<td>944</td>
</tr>
<tr>
<td>Borealis HE1878E-C2</td>
<td>9</td>
<td>952</td>
</tr>
</tbody>
</table>
Leading providers of innovative plastic solutions

Borealis and Borouge are leading providers of innovative plastics solutions that create value for society.

Building on the unique Borstar® and Borlink™ technologies and 50 years of experience in polyolefins, Borealis and Borouge support key industries including infrastructure, automotive and advanced packaging. Their manufacturing capacity reaches over 5.4 million tonnes of polyethylene and polypropylene per year.

Borealis is headquartered in Vienna, Austria, and operates in over 120 countries with around 6,200 employees worldwide. Borouge, its joint venture with the Abu Dhabi National Oil Company (ADNOC), employs approximately 1,700 people, has customers in more than 50 countries and its headquarters are in Abu Dhabi in the UAE and Singapore. Together, both companies provide services and products to customers around the world.

Borealis offers a wide range of base chemicals, including melamine, phenol, acetic acid, ethylene and propylene servicing a wide range of industries. Together with Borouge the two companies will produce approximately 6 million tonnes of Base Chemicals in 2014.

Borealis also creates real value for the agricultural industry with a large portfolio of fertilizers. The company distributes approximately 2.1 million tonnes per year. This volume will increase to around 5 million tonnes by the end of 2014.

Borealis and Borouge proactively benefit society by taking on today’s challenges and are working to drive ideas forward. Both companies are committed to the principles of Responsible Care®, driving improved safety performance within the chemical industry and contributing to addressing the world’s water and sanitation challenges through product innovation and their Water for the World™ programme.

For more information visit:
www.borealisgroup.com
www.borouge.com
www.waterfortheworld.net

Disclaimer The information contained herein is to our knowledge accurate and reliable as of the date of publication. Borealis and Borouge extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the consequences of its use or for any printing errors. It is the customer’s responsibility to inspect and test our products in order to satisfy himself as to the suitability of the products for the customer’s particular purpose. The customer is also responsible for the appropriate, safe and legal use, processing and handling of our products. Nothing herein shall constitute any warranty (express or implied, of merchantability, fitness for a particular purpose, compliance with performance indicators, conformity to samples or models, non-infringement or otherwise), nor is protection from any law or patent to be inferred. Insofar as products supplied by Borealis and Borouge are used in conjunction with third-party materials, it is the responsibility of the customer to obtain all necessary information relating to the third-party materials and ensure that Borealis and Borouge products, when used together with these materials, are suitable for the customer’s particular purpose. No liability can be accepted in respect of the use of Borealis and Borouge products in conjunction with other materials. The information contained herein relates exclusively to our products when not used in conjunction with any third-party materials.

Borstar is a registered trademark of the Borealis Group. Borlink and Water for the World are trademarks of the Borealis Group.