DRIVING DESIGN INNOVATION

Styrenic solutions for the automotive industry
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A forward-thinking purchasing manager at an automotive OEM needs a global and reliable supplier with polymer application expertise. Specifically, it could be for a new steering wheel housing his company is developing to meet changing regulatory requirements, or it could be for a pre-colored interior trim that needs to be affordable, lighter and more durable. Styrenics from INEOS Styrolution provide the innovation and superior aesthetics he requires. INEOS Styrolution offers a deep understanding of the complex interdependency of materials and design.

“What are the unique properties of Styrenics that make them so attractive to the automotive sector?”
INNOVATION AT THE CROSSROADS OF FUNCTION AND FORM

We live in a world of unprecedented change in global production, trade and consumption. In the automotive sector, this means that greater demands for fuel efficiency – ecological, legal and consumer-based – are driving alternative power train development, the use of lighter weight materials and regulatory change. Emerging markets are the incubators of huge numbers of new consumers and everywhere the value chain is becoming more diverse and more complex.

Take just one example: aesthetics. Polymers in car exteriors offer visible proof of vehicle quality, superiority and differentiated overall performance. At the same time, they are also used to improve the look and feel of lower cost automobiles. The easy processability and coloring characteristics of styrenic polymers also make them attractive to designers and manufacturers, allowing changes to be simpler and more cost effective. Plus, they enable expanded customer choice.

**STYRENIC SPECIALTIES STAND FOR AFFORDABLE HIGH AESTHETICS**

Low system costs and exceptional aesthetic solutions for interior and exterior applications, such as high and low gloss, weatherability, and unpainted solutions.

<table>
<thead>
<tr>
<th>High UV Resistance</th>
<th>Easy Painting</th>
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<td>Deep Colors</td>
<td>Unpainted Solutions</td>
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<td>Low Density</td>
<td>Excellent Low Density</td>
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<td>Weathering</td>
<td>Optimal Scratch Resistance</td>
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<tr>
<td>Hot Stamping</td>
<td>Excellent Dimensional Stability</td>
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**STYRENICS PROPERTIES THAT OUTPERFORM**

Some of the reasons styrenic specialties are becoming the automotive polymer of choice.

HOW STYRENIC SOLUTIONS ARE SHAPING THE FUTURE

Styrenics are a family of unique thermoplastics with a broad range of applications. Styrenics are being used in more and more applications in the automotive sector because of properties like lower density, excellent aesthetics and superior processing abilities. At the end of the day, the balanced performance of styrenics delivers high surface quality at low cost, resulting in greater customer satisfaction.

Additionally, the unique characteristics of styrenics materials make secondary operations such as gluing, in-mold decorating, welding, painting and electroplating easy and affordable.
The advanced development engineer of a large Tier 1 manufacturer is considering the design concept for the next model of a global brand. The innovation behind styrenic specialties not only provides him with superior aesthetics, reduced weight and increased resistance to weather and ageing, but also the flexibility to choose between injection molding or extrusion. So styrenics provide him complete freedom of color and design across all applications.

"WHY ARE STYRENIC SPECIALTY SOLUTIONS SO ATTRACTIVE TO CONSUMERS, DESIGNERS AND MANUFACTURERS?"
Whether for rearview mirrors or instrument panels, front grills or rear lights, automotive applications based on styrenics solutions are growing. It is not just superior performance and physical durability that make styrenics attractive for manufacturers all along the automotive value chain. There’s also easy processability and low density. And, of course, the exceptionally compelling aesthetics: styrenics based products look better.

Styrenics address two of the attributes most desirable to automotive OEMs and suppliers: appearance and low weight. The depth and breadth of the aesthetic and design possibilities of styrenics make them ever more interesting to engineers and designers alike. Here is a sampling:

### GREATER INSPIRATION FOR GROWING APPLICATIONS

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### AUTOMOTIVE STYRENIC APPLICATIONS INSIDE & OUT

#### INTERIOR APPLICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DOOR PANELS</strong></td>
<td>• high impact resistance, high heat resistance, excellent flow, low emission and dimensional stability</td>
</tr>
<tr>
<td><strong>CENTER CONSOLES</strong></td>
<td>• adaptable to specific requirements, such as high heat, high impact and high-level aesthetics</td>
</tr>
<tr>
<td><strong>INSTRUMENTAL PANEL COMPONENTS</strong></td>
<td>• high impact resistance, high surface quality aesthetics, outstanding acoustic properties, and high dimensional stability</td>
</tr>
<tr>
<td><strong>INTERIOR UPPER AND LOWER TRIMS</strong></td>
<td>• high quality, low emission, high impact, high heat, and UV resistance</td>
</tr>
<tr>
<td><strong>SEAT COVERS</strong></td>
<td>• high impact resistance, enhanced UV resistance and colour fastness</td>
</tr>
</tbody>
</table>

#### EXTERIOR APPLICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPOilers</strong></td>
<td>• high impact resistance, high heat resistance, enhanced UV performance</td>
</tr>
<tr>
<td><strong>ELECTROPLATED TRIMS</strong></td>
<td>• very high impact strength and high flowability</td>
</tr>
<tr>
<td><strong>FRONT GRILLS AND REARVIEW MIRRORS</strong></td>
<td>• color retention, high impact, aesthetics and processability</td>
</tr>
<tr>
<td><strong>REAR AND FRONT LIGHTS</strong></td>
<td>• highest heat-resistant ABS on the market, platable, excellent flow for high surface quality</td>
</tr>
<tr>
<td><strong>FASCIA AND MOUNTING BRACKETS</strong></td>
<td>• high impact resistance, high heat resistance</td>
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**INEOS STYROLUTION: DRIVING DESIGN INNOVATION**

**DOOR PANELS**
- HH ABS (Novodur®)
- ABS/PA or ASA/PA (Terblend® N/S)

**DOOR PANELS**
- HH ABS (Novodur®)
- ABS/PA or ASA/PA (Terblend® N/S)

**CENTRAL CONSOLES**
- HH ABS (Novodur®)
- ABS/PA or ASA/PA (Terblend® N/S)
- electroplated ABS (Novodur®)

**REAR SPOILERS**
- painted HH ABS (Novodur®)
- ASA (Luran® S)
- ASA/PC (Luran® SC)

**INSTRUMENT PANEL COMPONENTS**
- painted HH ABS (Novodur®)
- ABS/PA or ASA/PA (Terblend® N/S)

**REAR LIGHT HOUSINGS**
- HH ABS (Novodur®)
- ASA (Luran® S)
- HH ABS (Novodur®)

**FRONT LIGHTS**
- HH ABS (Novodur®)
- painted HH ABS (Novodur®)

**FRONT GRILLS**
- painted HH ABS (Novodur®)
- ASA (Luran® S)
- ASA/PC (Luran® SC)

**BUMPER AND FASCIA BRACKETS**
- ASA (Luran® S)
- ASA/PC (Luran® SC)
- HH ABS (Novodur®)

**MIRROR TRIANGLES**
- high gloss HH 120 (Luran®)
- ASA (Luran® S)

**REAR VIEW MIRRORS**
- ASA (Luran® S)
- painted ABS (Novodur®)

**FRONT GRILLS**
- painted HH ABS (Novodur®)
- ASA (Luran® S)
- ASA/PC (Luran® SC)

**REAR LIGHT HOUSINGS**
- ASA (Luran® S)
- ASA/PC (Luran® SC)
- HH ABS (Novodur®)

**EXTerior TRIMs**
- electroplated ABS (Novodur®)
- ASA (Luran® S)
- painted HH ABS (Novodur®)

**SEAT COVERS**
- painted HH ABS (Novodur®)
- ABS/PA or ASA/PA (Terblend® N/S)

**LOUD-SPEAKER GRILLS**
- ABS/PA or ASA/PA (Terblend® N/S)

**REAR LIGHT HOUSINGS**
- HH ABS (Novodur®)
- ASA (Luran® S)
- painted HH ABS (Novodur®)

**MIRROR TRIANGLES**
- high gloss HH 120 (Luran®)
- ASA (Luran® S)

**CENTRAL CONSOLES**
- HH ABS (Novodur®)
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- painted HH ABS (Novodur®)
- ASA (Luran® S)
- ASA/PC (Luran® SC)
The Head of Design at a major global car company relies on INEOS Styrolution because she knows she can count on them as a trusted global supplier with a large portfolio and broad expertise to help her balance optics, function and costs across a wide range of applications and regional demands. With INEOS Styrolution she gets solutions to launch new global platforms with local material supplies, while also addressing regional design trends.

“How DOES INEOS STYROLUTION FACILITATE THE DEVELOPMENT AND IMPLEMENTATION OF INNOVATIVE AUTOMOTIVE SOLUTIONS?”
INEOS Styrolution invests its success in the success of its customers. The company provides customers with the broadest styrenic specialty product portfolio in the industry, backed by the resources of R&D, consistent reliability and sustainability, as well as a dedicated, experienced sales and technical team within each region.

To grow customer value, INEOS Styrolution not only offers exceptional global presence, but also innovative technology. This includes cutting-edge competence in plastic design, color and new applications. This ranges from an expanding array of lower cost alternatives for painted plastic parts to a constant effort to improve the feel and visual appearance of all surfaces, with a unique emphasis on light, stable and pre-colored materials for interior and exterior applications.

INNOVATIVE MATERIALS
INEOS Styrolution specialty product innovations include:

- novodur® Ultra 4255 – for interior and exterior applications, such as door panels, consoles, lower seat trims and glove box doors and frames, combines high impact strength at room as well as at low temperature, 100% ductility at -30 °C, high heat resistance and a best-in-class flowability.
- novodur® Ultra 4140Pg – for electroplated decorative parts – a styrenic blend and the newest member of our family of electroplatable product portfolio which includes novodur P2MC. It provides exceptional heat and impact resistance for both interior and exterior applications, and can be conveniently processed on standard electroplating production lines.
- Terblend® S Sg-02ef – for interior applications, such as air vents – a styrenic blend and the newest member of our family of electroplatable product portfolio which includes Novodur P2MC. It provides exceptional heat and impact resistance for both interior and exterior applications, and can be conveniently processed on standard electroplating production lines.
- Terblend® S 5G-QE2F – for interior applications, such as air vents – a low-emission and 8% glass-fiber reinforced grade with superior heat resistance and dimensional stability, provides a cost-effective matte surface finish that doesn’t require painting.

GLOBAL REGULATORY SUPPORT IMDS
TECHNICAL DEVELOPMENTAL SUPPORT
(processing, design, CAE simulation)

ENHANCED QUALITY CONTROL PROCESSES
ISO 1901

DEDICATED QUALITY
and global technical teams

SECURITY OF SUPPLY
long-term and global availability

DESIGN SUPPORT
for part and injection molding tools

SECONDARY OPERATION EXPERTISE
(painting, gluing, in-mold decoration, electroplating)

SPECIFICATION OF MATERIAL
at OEMs

IN THREE SIMPLE STEPS

AUTOMOTIVE PROJECT MANAGEMENT SUPPORT

SOLUTIONS THAT KEEP YOU ON TRACK – SERVICE THAT KEEPS YOU ON TIME

How INEOS STYROLUTION SERVES YOU
### Polymers

<table>
<thead>
<tr>
<th>Polymer</th>
<th>ABS</th>
<th>ABS/PC</th>
<th>Electroplatable Grades</th>
<th>ASA</th>
<th>ASA/PC</th>
<th>SAN</th>
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<tbody>
<tr>
<td>Density</td>
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### Typical Values for Uncolored Products at 23 °C

| Test Method | Unit | terluran® | gp-22 | novoDur® | p2h-at | novoDur® | h605 | novoDur® | h701 | novoDur® | h702 | novoDur® | hh-106 | novoDur® | hh-112 | novoDur® | h802 | novoDur® | hh-106 g1 | novoDur® | hh-106 g2 | novoDur® | p2hgv | novoDur® | ultra 4105 | novoDur® | ultra 4255 | novoDur® | p2mc | novoDur® | ultra 4140pg |
|-------------|------|----------|--------|----------|--------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|
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### Properties

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<tr>
<th>Property</th>
<th>Polymeric Abbreviations</th>
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<tbody>
<tr>
<td>Density</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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<tr>
<td>Moisture absorption, equilibrium at 23°C/50% r.H.</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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### Processing

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<tr>
<th>Property</th>
<th>Polymeric Abbreviations</th>
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</thead>
<tbody>
<tr>
<td>Melt Volume Rate mVR 220°C/10 kg</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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### Mechanical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Polymeric Abbreviations</th>
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<tr>
<td>Tensile modulus</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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<tr>
<td>Tensile stress at yield</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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<tr>
<td>Tensile strain at yield</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
</tr>
<tr>
<td>Tensile strain at break</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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<tr>
<td>Flexural strength</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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<tr>
<td>Flexural modulus</td>
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### Thermal Properties

<table>
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<tr>
<th>Property</th>
<th>Polymeric Abbreviations</th>
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<tr>
<td>Heat deflection temperature; HDT a (1.80 mPa)</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
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<tr>
<td>Heat deflection temperature; HDT b (0.45 mPa)</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
</tr>
<tr>
<td>Vicat softening temperature VST/b/50 (50 N, 50 K/h)</td>
<td>isostyrolution Products for Automotive isostyrolution Products for Automotive</td>
</tr>
</tbody>
</table>

### References

Date 1918, 19
### Typical values for uncolored products at 23 °C

#### Density
- **NovoDur®** 550: 1.183 kg/m³
- **Absolac®** 120HR: 1.040 g/cm³
- **Absolac® e502 bml**: 1.045 g/cm³

### Processing

#### Melt Volume Rate mVR
- **NovoDur®** 550: 1133 cm³/10 min
- **Absolac®** 120HR: 3.0 cm³/10 min
- **Absolac® e502 bml**: 2.5 cm³/10 min

#### Melt Flow Rate mFR
- **NovoDur®** 550: 21 g/10 min
- **Absolac®** 120HR: 10 g/10 min
- **Absolac® e502 bml**: 2.5 g/10 min

### Mechanical Properties

#### Tensile Modulus
- **NovoDur®** 550: 527 MPa
- **Absolac®** 120HR: 2.100 MPa
- **Absolac® e502 bml**: 2.600 MPa

#### Tensile Stress at Yield
- **NovoDur®** 550: 40 MPa
- **Absolac®** 120HR: 48 MPa
- **Absolac® e502 bml**: 53 MPa

#### Tensile Stress at Break
- **NovoDur®** 550: 28%
- **Absolac®** 120HR: 2.8%
- **Absolac® e502 bml**: 3.2%

#### Flexural Strength
- **NovoDur®** 550: 178 MPa
- **Absolac®** 120HR: 60 MPa
- **Absolac® e502 bml**: 65 MPa

#### Flexural Modulus
- **NovoDur®** 550: 1.570 GPa
- **Absolac®** 120HR: 2.350 GPa
- **Absolac® e502 bml**: 2.550 GPa

### Thermal Properties

#### Heat Deflection Temperature; HDTa (1.80 mPa)
- **NovoDur®** 550: 93 °C

#### Heat Deflection Temperature; HDTb (0.45 mPa)
- **NovoDur®** 550: 108 °C

#### Vicat Softening Temperature, VST/b/50
- **NovoDur®** 550: 296 °C

### Moisture Absorption, Equilibrium
- **NovoDur®** 550: 0.3%

### Linear Temperature Range
- **NovoDur®** 550: 250 - 280 °C
- **Absolac®** 120HR: 250 - 270 °C
- **Absolac® e502 bml**: 250 - 280 °C

### Initial Moisture Absorption
- **NovoDur®** 550: 0.62%
- **Absolac®** 120HR: 0.54%
- **Absolac® e502 bml**: 0.56%

### Flammability

#### UL 94 V: 5VP
- **NovoDur®** 550: V-0
- **Absolac®** 120HR: V-0
- **Absolac® e502 bml**: V-0

#### UL 94 V: 0VP
- **NovoDur®** 550: V-0
- **Absolac®** 120HR: V-0
- **Absolac® e502 bml**: V-0

### Discovery the Versatility of Automotive Applications

**Discover the versatility of automotive applications.**
Collaborating for lasting innovation

After launching a company to mold plastic parts for the automotive industry, rapid growth in Asian OEMs helped a young entrepreneur’s business move up the value chain to parts manufacturer. Now he is producing sophisticated vehicle systems thanks to collaborative innovation with INEOS Styrolution. Together they were able to identify a gap in the supply chain for lightweight side panels with premium aesthetics, exceptional performance and the flexibility of 2,500 color options. And that’s only the beginning of his success story.

“WHY DO MANUFACTURERS PREFER INEOS STYROLUTION TO OTHER STYRENIC SOLUTION PROVIDERS?”
A PIONEER GOES FURTHER
WITH A RELIABLE PARTNER

INEOS Styrolution offers global assistance with a personal touch. Whenever specialized innovation is required, INEOS Styrolution works hand-in-hand with its customers to help them gain a competitive advantage – through best-in-class service and customized solutions.

With first-rate technology, leading R&D skills and strong intellectual property and patent positions, INEOS Styrolution is uniquely equipped to ensure that new applications find the right formulation for success. To enable best possible quality and process efficiency, INEOS Styrolution provides testing and technical support in the processing, design and computer simulation phases.

Thanks to its broad experience and processing expertise, INEOS Styrolution is an attractive partner for developing new products, technologies and solutions for automotive customers.

TURNING IDEAS INTO PROFIT

Each new product or new application begins with an idea. Together with INEOS Styrolution, customers define how those ideas are transformed into real, innovative and practical items for use in the household sector.

WHY COLLABORATING WITH INEOS STYROLUTION IS DIFFERENT: STEP BY STEP

1. An automotive OEM or a large Tier 1 customer faces a challenge or has a wish and communicates this to INEOS Styrolution.
2. INEOS Styrolution listens, reflects, and asks for specific application, regulatory requirements.
3. INEOS Styrolution draws on its wide expertise to present the customer with the optimal mix of existing formulations and promising fields of development.
4. INEOS Styrolution delivers customized products for customer sampling and test evaluation according to part specifications.
5. Customer and INEOS Styrolution work in collaborative innovation to finalize plans to create the new application.
6. Once validated by the OEM, the project for a new vehicle platform can begin.
Styrenics are one of the most versatile materials in the 21st century, and have revolutionised the way we live today. Our products have become an indispensable part of consumers’ everyday lives and provide solutions to societal challenges such as climate change, resource scarcity, urbanisation, rising living standards and population growth.

The solutions styrenics products offer include extending food shelf life thereby reducing food waste, while also providing lightweight solutions for the automotive industry leading to lower fuel consumption.

Our brand-new ECO range not only complements INEOS Styrolution’s existing strong portfolio of styrenics standard products and specialties, but also matches the performance of our existing portfolio.
INEOS Styrolution is the only global company focused solely on styrenics with a broad product portfolio and proven customized approach to co-development. INEOS Styrolution delivers innovation and professional support with an experienced, personal touch.
INEOS STYROLUTION AT A GLANCE

INEOS Styrolution is the global leader in styrenics – and the world’s leading supplier of automotive styrenics. The company also provides styrenic applications for many everyday products across a broad range of other industries, including healthcare, electronics, household, construction, toys/sports/leisure, and packaging.

INEOS STYROLUTION SERVES THE AUTOMOTIVE INDUSTRY AROUND THE WORLD WITH THE LARGEST PORTFOLIO OF STYRENICS SPECIALTIES, FUELED BY INNOVATION.

LET’S COLLABORATE

If you would like further details, need assistance in creating your applications, or are curious to explore new possibilities with styrenics, please contact us!

www.ineos-styrolution.com/industry/automotive.html

LOCAL REPRESENTATIVES

EUROPE, MIDDLE EAST AND AFRICA

INEOS Styrolution Group GmbH
Mainzer Landstrasse 50
60325 Frankfurt am Main
Germany

INSTY.info@ineos.com
+ 49 2133 9309168

AMERICAS

INEOS Styrolution America LLC
4245 Meridian Parkway, Suite 15
Aurora, IL 60504
USA

INSTY.americas@ineos.com
+1 866 890 6354

ASIA-PACIFIC

INEOS Styrolution APAC Pte Ltd
111 Somerset Road, #14-16 to 21
TripleOne Somerset
Singapore 238164

INSTY.asia@ineos.com
+65 2 6322 7775
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