<table>
<thead>
<tr>
<th>CONTENT</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our approach</td>
<td>3</td>
</tr>
<tr>
<td>Our NXT* silanes: ingredients for success</td>
<td>4-5</td>
</tr>
<tr>
<td>Our labs: where ideas take off</td>
<td>6</td>
</tr>
<tr>
<td>Our manufacturing facilities: prepared for the journey</td>
<td>7</td>
</tr>
<tr>
<td>Support for the road ahead</td>
<td>12</td>
</tr>
</tbody>
</table>
Momentive keeps tires moving forward

As rapidly evolving technology and increased global fuel consumption impose new demands on tires, we understand your need to manufacture a superior product that can go the distance. We also know that making a better product often requires going beyond the standard approach. That’s why we combine expertise, vision and scientific data to offer you unique solutions.

**Expertise for insight**

For many of our chemists and technicians, the journey to the world of tires began in a tire plant. Before they were members of the Momentive Performance Materials team of industry experts, they were “tire guys” like you. These award-winning individuals have secured more than 50 patents and have over 250 years of combined experience in the industry. This history and first-hand experience affords them a unique perspective when developing and fine-tuning formulations for you.

**Vision for innovation**

Fueled by the desire to revolutionize silica tire manufacturing, we introduced the first advanced silanes for tires over 20 years ago. Since then, we have remained committed to innovation with the NXT* silane line. NXT silanes help deliver the lowest rolling resistance possible while maintaining wet traction. These silanes can also offer a myriad of other benefits when formulated into the solutions we develop for you.

**Science for sophistication**

To ensure customers garner the ultimate benefits of NXT silanes and our unique solutions, we spend every day in the lab. Our chemists invent molecules in a synthesis facility and test materials in our state-of-the-art rubber lab. With this one-of-a-kind approach, we are able to continually examine performance properties and the effects of adjusting formulations until we reach the desired outcome. The end result is cutting-edge solutions for your specific applications.

**Products for the future**

Our unique approach and advanced silanes enable us to focus on the future of tires. We welcome the opportunity to mobilize our industry experience, NXT silanes and data-driven methods to help you deliver products not only for today’s world, but also for the needs of tomorrow.

*NXT is a trademark of Momentive Performance Materials Inc.*
NXT* silanes: ingredients for success

In paving the way for the future, we strive to conceive solutions that assist in realizing high-quality products and enhanced manufacturing. With NXT silanes, we offer a new level of support that can help you create tires that stand out in the showroom and perform on the road.

**Reduced rolling resistance**

With fuel reduction targets being mandated worldwide in the coming decades, it will be necessary to improve the rolling resistance of tires in order to meet new standards. Incorporating NXT silanes into the tire tread can lead to greatly improved rolling resistance ratings. As a result, tires can use less energy and fuel to function, without compromising safety.

**Better wet traction**

NXT silanes enable the reduced rolling resistance needed for fuel efficiency while maintaining wet traction. This critical safety feature can help vehicles stop faster and grip the road better, empowering you to further exceed consumer expectations.

**Desirable testing results**

NXT silanes offer design possibilities by helping you to achieve the following effects in rubber compounds:

- Improved Payne Effect
- Increased resilience
- Lower tan δ values (50 °C to 60 °C)
- Better dynamic properties at low temperatures (-20 °C to +10 °C)

**More efficient manufacturing**

Not only do NXT silanes enable better tire performance, they can help accelerate manufacturing. Despite high-silica loading formulas, these advanced silanes promote better dispersion. And, a reduced compound viscosity is possible for easier processing, mixing, milling and extrusion. This can result in numerous potential benefits including:

- Fewer steps in the fabrication process
- An increase in tread extrusion rate
- A smoother, cleaner tire tread profile
- A longer shelf life before re-milling is required
NXT* silane products

NXT Silane
NXT silane is a thiocarboxylate functional silane that has been shown to enable reduced rolling resistance while maintaining wet traction. This advanced silane offers tire manufacturers increased overall production efficiency compared to standard sulfur silanes.

Carbo NXT Silane
Carbo NXT silane is available in powder form for processing flexibility. This NXT silane offers tire manufacturers the same enhanced tire performance and increased efficiencies as the liquid form.

NXT LowV* Silane
NXT LowV silane can provide significant reductions in the ethanol released during tire manufacturing. Compared to other silanes, NXT LowV silane can reduce ethanol emissions by more than 66 percent. It also can decrease silica processing steps, saving manufacturers time and improving efficiency.

NXT Z* Silane
NXT Z silane is a revolutionary advanced silane that is virtually ethanol-free, features easier processing and enables shelf-stable compounds. This silane can dramatically improve the dynamic and physical properties of tires for unprecedented performance.

*NXT, NXT LowV and NXT Z are trademarks of Momentive Performance Materials Inc.
Our labs: where ideas take off

We recognize that selecting the right ingredients is just one stop on your road to success, and we believe in helping you prepare for the entire journey. An integral part of that philosophy is our unique ability to test silane solutions for performance in application. Our cutting edge laboratories in Tarrytown, NY, and Charlotte, NC, are where ideas are transformed into solutions.

Life in the lab
We spend each day in labs dedicated to evolving advanced silanes for the tire industry. We work with the materials that you incorporate into tires to know exactly how various rubber compounds will react in real-life situations. To generate this data, we develop solutions in the Tarrytown, NY, facility, and then fine-tune formulations in a series of rigorous tests at our state-of-the-art rubber lab in Charlotte, NC.

Demonstrating material performance
In our 20,000 square-foot tire lab in Charlotte, NC, we test NXT silane and other coupling agents in silica-filled systems by evaluating physical and dynamic properties. We predict rolling resistance, traction and rubber toughness by testing under tension, compression, bending and shear. Additionally, we measure silica dispersion and numerous other properties to identify potential manufacturing efficiencies.

Testing for complex challenges
At these facilities, we can investigate complex issues to help you find a solution specific to your requirements. Through extensive testing and analysis, we can identify and pinpoint notable performance properties that can help you produce a tire unlike any other.
Our manufacturing facilities: prepared for the journey

With a new manufacturing facility planned for Europe and a site in North America, we are prepared for the rapidly increasing global demand for high-performance tires. The new facility in Leverkusen, Germany, will double production capacity of NXT® silane products to deliver solutions more efficiently across the globe while our plant in the United States continues to serve customers worldwide. As global standards become more stringent, we are growing to help you ramp up the performance of your tires.
Typical compound research conducted in the lab comparing S2 and S4 silanes with NXT* silane are depicted in the following charts. This type of data helps our scientists better understand reversion, crosslink density, scorch and other compound characteristics to help you develop a compound that meets your needs. In these studies, standard S2 and S4 silanes in 80 phr loaded silica compounds are compared to NXT silane in 80 phr and 85 phr silica loaded compounds.

**Figure 1: Comparison of Batch Viscosities**

The viscosity of NXT compounds is typically lower than standard silane compounds, even with higher silica loading.

**Figure 2: Curve Comparison MDR at 160 ºC**

Initial torque and induction times can be improved by using NXT silane versus standard silanes, regardless of the silica loading.
The best combination of dynamic properties can be achieved with NXT silane. Lowest tan δ at 60 °C is indicative of lower rolling resistance, without loss of tan δ at 0 °C, which also suggests equal or better wet traction.

Note: Test data. Actual results may vary.
The $E''$ curves demonstrate lower damping with NXT* silane versus standard silanes, and the $E''$ curves verify an equal or better dynamic modulus. Lower rolling resistance can be expected when tan $\delta$ max values are reduced due to strong dynamic modulus and low damping.

**Figure 4: $E''$ Values, 10.0 Hz, at 55 °C**

![Figure 4: $E''$ Values, 10.0 Hz, at 55 °C](image)

Note: Test data. Actual results may vary.

**Figure 5: Strain Sweep, 10.0 Hz, at 55 °C**

![Figure 5: Strain Sweep, 10.0 Hz, at 55 °C](image)

Note: Test data. Actual results may vary.
Figure 8: Tan $\delta$ max Values, 10.0Hz, at 55 °C

Figure 7: Low Viscosity and Improved Storage Stability with NXT* Silane

Note: Test data. Actual results may vary.

Flocculation and the need for re-milling can be minimized in compounds made with NXT silane.

Note: Test data. Actual results may vary.
Customer Service Centers

Email
commercial.services@momentive.com

Telephone

Americas
+1 800 295 2392  
+1 614 986 2495

Europe, Middle East, Africa and India
00800 4321 1000  
+40 213 044229

Asia Pacific
China
800 820 0202

Japan
+81 276 20 6182

All Other Countries
+60 3 9206 1543

To find a specific language, visit the Contact Us page at Momentive.com. You may select a country to view additional languages and the corresponding telephone numbers.

For email inquiries, we will make every attempt to respond in the incoming written language. If that is not possible, we will respond in English.

Patent Status
Nothing contained herein shall be construed to imply the nonexistence of any relevant patents or to constitute the permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of the patent.

Product Safety, Handling and Storage
Customers should review the latest Safety Data Sheet (SDS) and label for product safety information, safe handling instructions, personal protective equipment if necessary, emergency service contact information, and any special storage conditions required for safety. Momentive Performance Materials (MPM) maintains an around-the-clock emergency service for its products. SDS are available at www.momentive.com or, upon request, from any MPM representative. For product storage and handling procedures to maintain the product quality within our stated specifications, please review Certificates of Analysis, which are available in the Order Center. Use of other materials in conjunction with MPM products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

Limitations
Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

DISCLAIMER:
THE MATERIALS, PRODUCTS AND SERVICES OF MOMENTIVE PERFORMANCE MATERIALS INC. AND ITS SUBSIDIARIES AND AFFILIATES (COLLECTIVELY “SUPPLIER”), ARE SOLD SUBJECT TO SUPPLIER’S STANDARD CONDITIONS OF SALE, WHICH ARE INCLUDED IN THE APPLICABLE DISTRIBUTOR OR OTHER SALES AGREEMENT, PRINTED ON THE BACK OF ORDER ACKNOWLEDGMENTS AND INVOICES, AND AVAILABLE UPON REQUEST. ALTHOUGH ANY INFORMATION, RECOMMENDATIONS, OR ADVICE CONTAINED HEREIN IS GIVEN IN GOOD FAITH, SUPPLIER MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, (I) THAT THE RESULTS DESCRIBED HEREIN WILL BE OBTAINED UNDER END-USE CONDITIONS, OR (II) AS TO THE EFFECTIVENESS OR SAFETY OF ANY DESIGN INCORPORATING ITS PRODUCTS, MATERIALS, SERVICES, RECOMMENDATIONS OR ADVICE. EXCEPT AS PROVIDED IN SUPPLIER’S STANDARD CONDITIONS OF SALE, SUPPLIER AND ITS REPRESENTATIVES SHALL IN NO EVENT BE RESPONSIBLE FOR ANY LOSS RESULTING FROM ANY USE OF ITS MATERIALS, PRODUCTS OR SERVICES DESCRIBED HEREIN. Each user bears full responsibility for making its own determination as to the suitability of Supplier’s materials, services, recommendations, or advice for its own particular use. Each user must identify and perform all tests and analyses necessary to assure that its finished parts incorporating Supplier’s products, materials, or services will be safe and suitable for use under end-use conditions. Nothing in this or any other document, nor any oral recommendation or advice, shall be deemed to alter, vary, supersede, or waive any provision of Supplier’s standard Conditions of Sale or this Disclaimer, unless any such modification is specifically agreed to in a writing signed by Supplier. No statement contained herein concerning a possible or suggested use of any material, product, service or design is intended, or should be construed, to grant any license under any patent or other intellectual property right of Supplier covering such use or design, or as a recommendation for the use of such material, product, service or design in the infringement of any patent or other intellectual property right.

Momentive and the Momentive logo are trademarks of Momentive Performance Materials Inc.

*NXT, NXT LowV and NXT Z are trademarks of Momentive Performance Materials Inc.