How we’re improving filler systems for tires

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March 26, 2015, Wesseling
Investments in silica and silane research

Evonik develops improved filler systems for modern, high-performance tires.
Major levers for efficient mobility

Tires

Lightweight construction

Lubricants
Tire tread composition of “green tires”

- Rubber polymers
- Additives
- Silane
- Active fillers (silica)
Fuel-saving “green tires”

• Reinforcing fillers made with highly dispersible (HD) silica instead of carbon black
• Silane serves as a coupling agent between the synthetic rubber and the silica
• Improved wet traction and reduced rolling resistance with virtually even abrasion

Reducing rolling resistance by 20 to 30 percent can reduce fuel consumption by up to 8 percent.
Silane produces a chemical bond between the silica filler and the polymer in the tire tread.
International trend towards tire labeling

- EU tire labeling requirement (as of Nov. 1, 2012): information on rolling resistance, wet grip, and exterior noise
- Meeting fuel consumption and wet grip specifications will require additional product innovations
“Green tires” with silica and silane are in high global demand

Global passenger vehicle tire sales

- 1.4 billion tires sold worldwide in 2010
- 1.2 billion tires sold worldwide in 2015* (projected)

- Green tires as a percentage of total sales:
  - 10% in 2010
  - 30% in 2015*

- Annual growth rate on the retail market for green tires (2010 to 2015): +30%

- Silica capacity expansion through 2015: +30%
Global production network

- Rheinfelden, Kalscheuren, Germany
- Antwerp, Oostende, Belgium
- Mobile, USA
- Chester, USA
- Zubillaga-Lantaron, Spain
- Wesseling, Germany
- Adapazari, Turkey
- Rizhao, China
- Akoh, Japan
- Ta Yuan, Taiwan
- Nanping, China
- Gajraula, India
- Maptaphud, Thailand

- Production sites for liquid rubber silanes
- Production sites for silane blends
- Production sites for tire silica
- Production sites under construction/expansion

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How we’re making “green tires” even better

• By developing new silica grades that provide high reinforcement potential and excellent dispersibility for use in winter tires, ultra-high-performance summer tires, and truck tires.

• By optimizing the processability of silanes

• By eliminating VOC release from the silanization reaction

• By developing solid silanes for easier dosing
Our silica product portfolio is constantly growing

Highly dispersible silicas for tires introduced over the past five years:

- Low-surface HD silica, for applications such as winter tires
- HD silica for balanced summer and winter tires that have been optimized for rolling resistance
- High-surface HD silica with high reinforcement potential for ultra-high-performance tires (UHP)
The development of rubber silanes follows changing market demands
Si 363® – the silane offering the greatest reduction in rolling resistance – can be a challenge in processing, depending on formulation and equipment.

The solution: combining silane with selected processing aids.

**Sheet appearance**

| Si 363® without processing aids | Si 363® with processing aids |

Si 363® performance remains unchanged.
Our first VOC-free silane

• XP Si 466 GR® is a new, VOC-free silane (VOC = volatile organic compounds)
  – No ethanol emissions during the silica reaction
  – No ethanol emissions from the finished tire
• Easier to dose in granulate form
• Additional advantage: saves the use of activators like DPG (diphenyl guanidine)
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<tr>
<th>Trend in the tire industry</th>
<th>Research priority</th>
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<td>• Reducing rolling resistance in truck and bus tires</td>
<td>• Developing a silica/silane system for natural rubber</td>
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<td>• Making silica/silane easier to process and reducing energy and manufacturing costs</td>
<td>• New silica with improved dispersion characteristics</td>
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