



How we're improving filler systems for tires

Ralph Marquardt
March 26, 2015, Wesseling



EVONIK
INDUSTRIES

Investments in silica and silane research

**Evonik develops improved
filler systems for modern,
high-performance tires.**

Major levers for efficient mobility



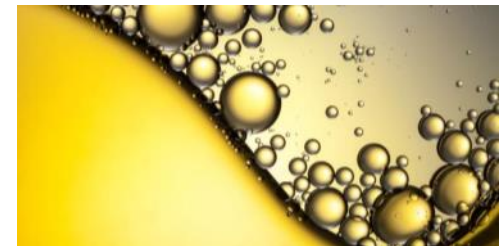
Tires



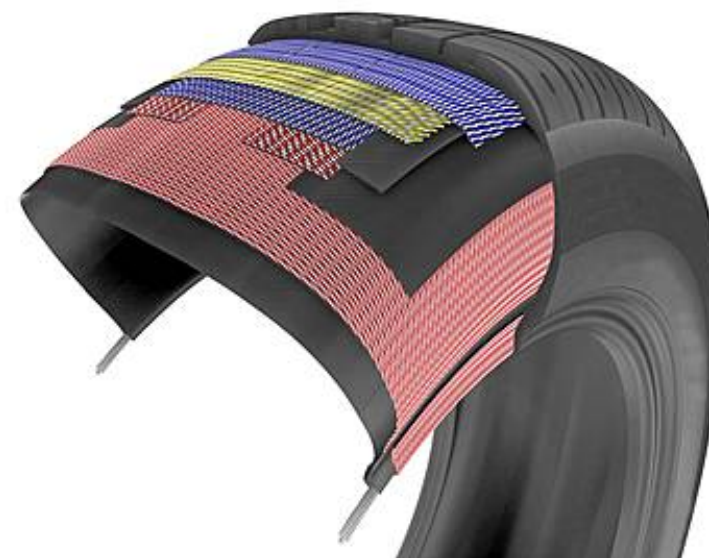
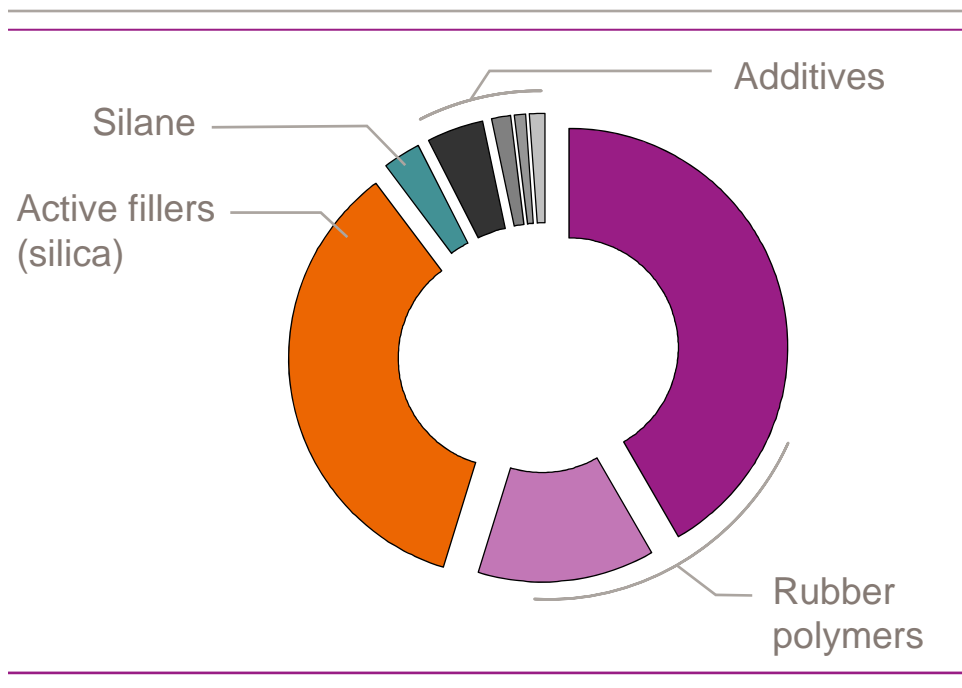
Lightweight construction



Lubricants



Tire tread composition of “green tires”

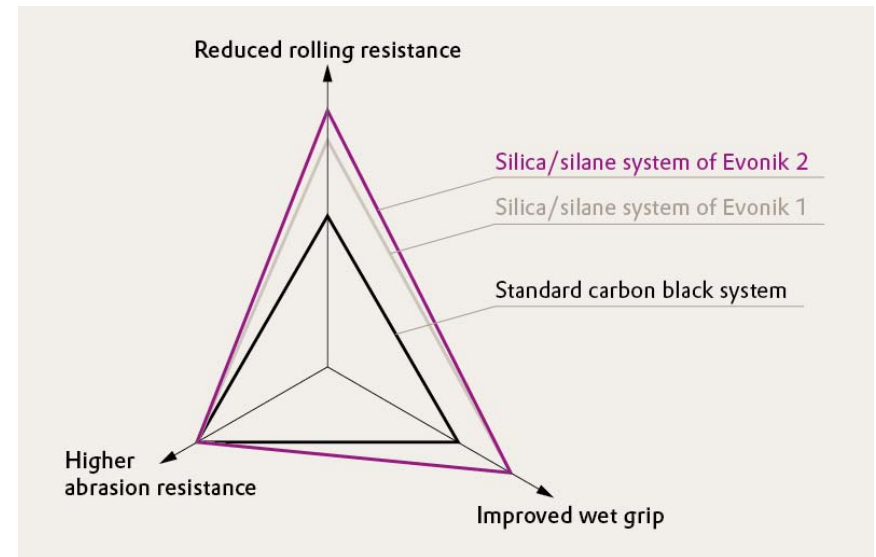


The magic triangle



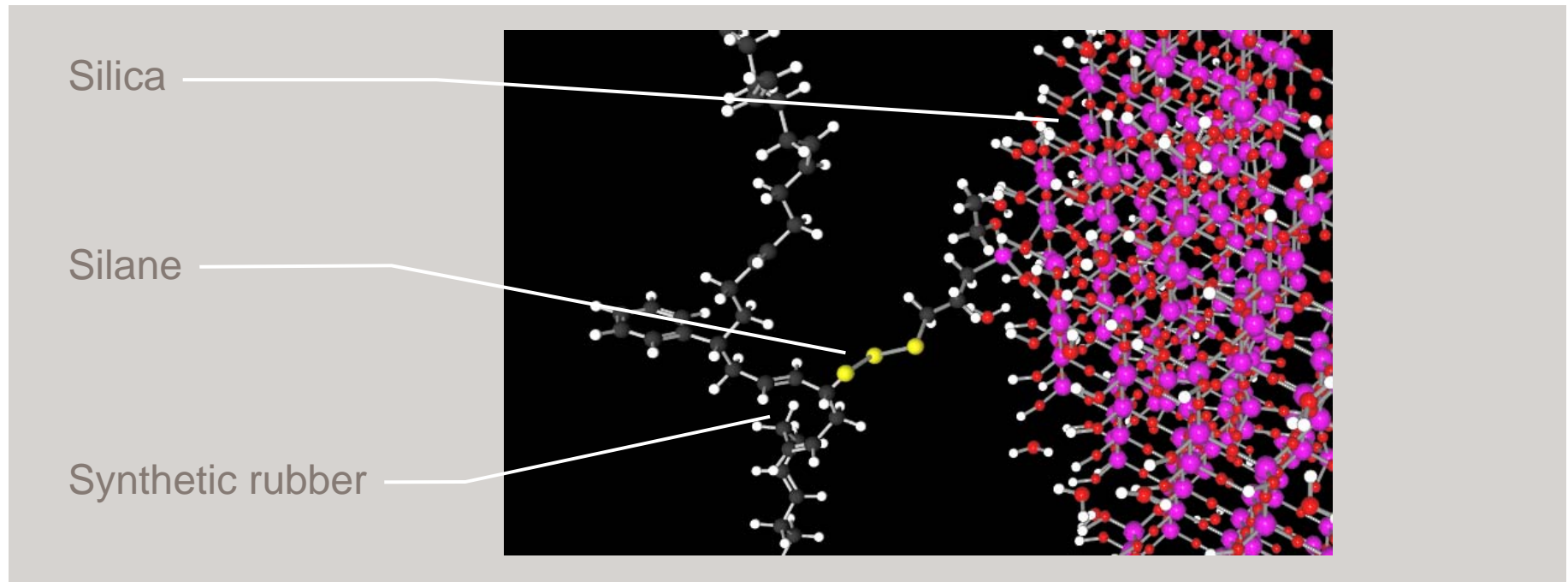
Fuel-saving “green tires”

- 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.

Modern tires with the silica/silane system

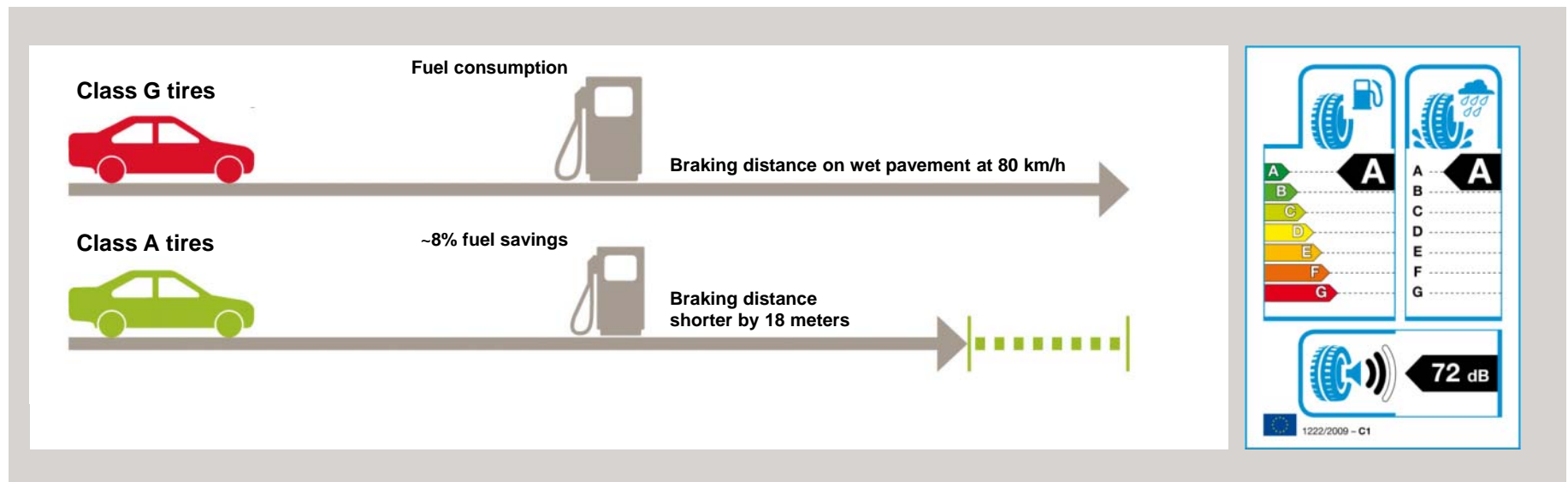


Silane produces a chemical bond between the silica filler and the polymer in the tire tread.

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



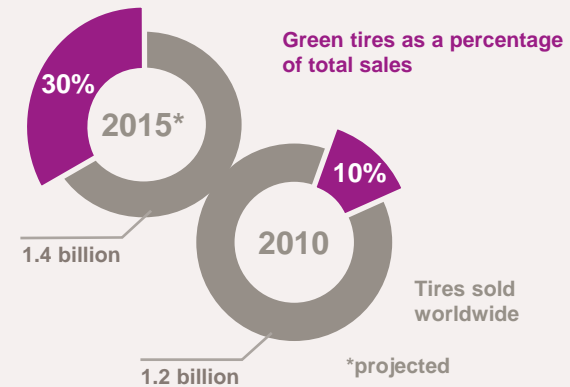
“Green tires” with silica and silane are in high global demand



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

+30%
Silica capacity expansion through 2015

Global passenger vehicle tire sales



Global production network



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

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

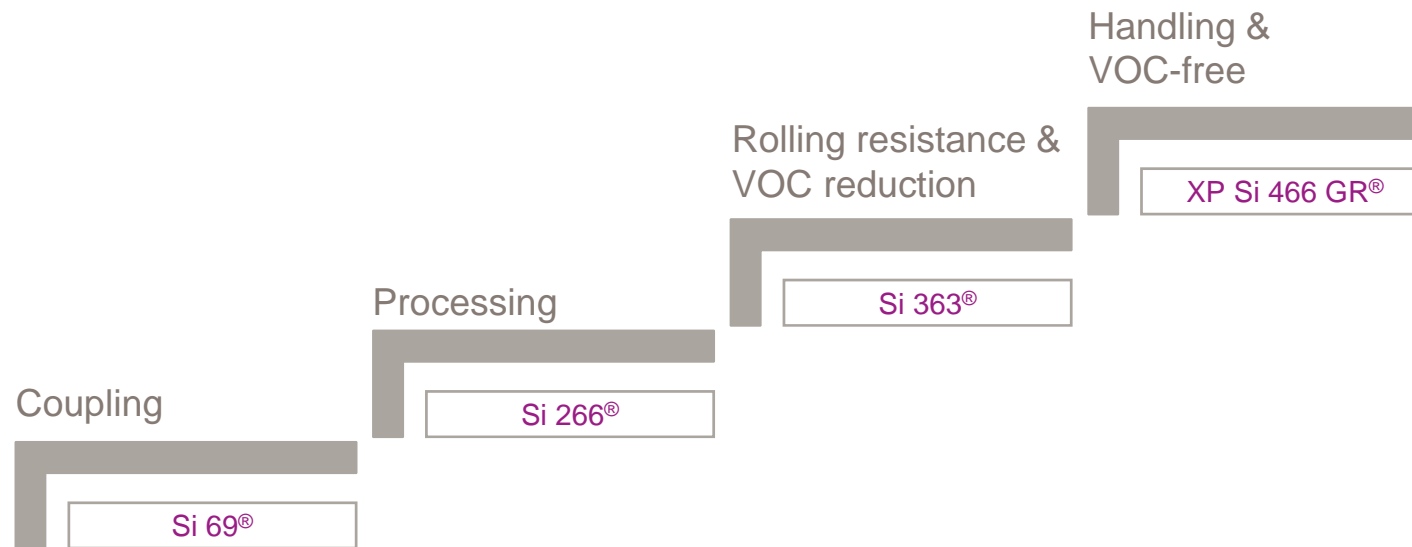


High-surface HD silica with high reinforcement potential for ultra-high-performance tires (UHP)

reinforcement



Silane development



The development of rubber silanes follows changing market demands

Improving processing characteristics of Si 363[®]

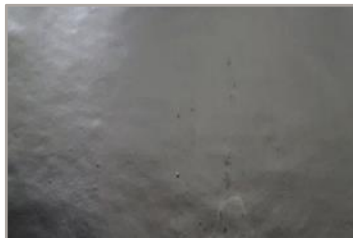


- Si 363[®] – the silane offering the greatest reduction in rolling resistance – can be a challenge in processing, depending on formulation and equipment
- The solution: combining silane with selected processing aids

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)



Industry trends and current innovation priorities



Trend in the tire industry

- Reducing rolling resistance in truck and bus tires

Research priority

- Developing a silica/silane system for natural rubber

Trend in the tire industry

- Making silica/silane easier to process and reducing energy and manufacturing costs

Research priority

- New silica with improved dispersion characteristics



EVONIK
INDUSTRIES