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## Rubber For More Kilometers



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State-of-the-art tire rubber helps save fuel. At a time when natural resources are becoming ever scarcer, the efficiency with which our vehicles transfer the engine's propulsion energy to the road plays an increasingly important role. State-of-the-art synthetic rubber can be used to modify tire properties so as to significantly reduce fuel consumption.

On freeways, tires currently account for around a fifth of fuel consumption, and in urban traffic, this figure can be as high as 30 percent. This fraction can be reduced substantially through the use of tire materials such as butyl rubbers (IIR), new, modified grades of solution styrene-butadiene rubber (SSBR) and refined grades of neodymium-polybutadiene rubber (Nd-BR).

"Developing new grades of tire rubber that help save energy but at the same time offer an equally high level of safety is a task for experienced chemists," says Christoph Kalla, head of Marketing & Research in the Performance Butadiene Rubbers business unit at LANXESS, "because some of the key properties of a tire are very difficult to optimize without impairing others. For example, it used to be a big problem to improve rolling resistance – a measure of the energy loss through the tire – without impairing abrasion resistance and wet grip. We anticipate that the rolling resistance of the next tire generation can be lowered by up to 10 percent merely by using currently available high-performance grades of tire rubber. Naturally without having to make any compromises on vehicle safety – quite the opposite in fact!"

### Saving at the molecular level

The cause of high rolling resistance may be high internal friction of tire components. The "expander cord" effect can also play a part: If a rubber contains too many molecules with loose ends, it cannot make optimal use of the energy. These loose ends, much like torn expander cords, contribute virtually nothing to transmitting forces in the tire, yet they still have to be moved along.

It should be possible, for example, to reduce the internal friction of the silica gel filler particles that give the rubber its stability with the help of modified SSBR rubber from LANXESS. Expressed in layman's terms, the molecules of these rubber raw materials have a high density of "sticky" anchor points that stick particularly well to the hard filler particles and basically cover them with a thick, friction-reducing rubber skin. This "wrapping-up" of the silica gel particles optimizes the polymer/filler network, and this should have a positive effect on road grip and abrasion. Initial laboratory and practical tests indicate that tires made of these materials not only have good rolling resistance, they also give outstanding grip. On top of that, they have a very long service life.

The number of "loose ends" in the rubber matrix is, in turn, much lower in Nd-BR rubber than in other grades of tire rubber. What's more, because of complex physical relationships, e.g. a narrow molecular weight distribution, producers can now manufacture tires with outstanding physical data using rubber raw materials that are also easier to process than before. At the same time, the supplier's latest grades of Nd-BR rubber result in more uniform, homogeneous products than many polybutadiene rubber types of former generations.



***Christoph Kalla***
*head of Marketing & Research in the Performance Butadiene Rubbers business unit*

Finally, largely air-impermeable grades of butyl rubber help keep tire pressure constant for a longer time. New IIR grades can, through their higher isoprene content, be vulcanized better than present products in the manufacturer's portfolio.

### New methods and catalysts support product development

Another topical focus of R&D at the specialty chemicals group is specifically varying the molecular microstructure of styrene-polybutadiene tire rubber. New catalysts and increasingly sophisticated process engineering will help to further lower the rolling resistance of new high-performance tires, and thus help to extend the range, including for electric cars, while at the same time making them safer.

"However," continues Kalla, "the term 'sustainability' should not be reduced solely to the question of fuel consumption. Avoiding waste, for instance, is another important aspect of sustainability." Here, too, modern, high-performance grades of Nd-BR rubber from LANXESS exhibit a number of positive characteristics: For example, they cushion confrontations with curbs better than many other rubber materials, which means that not only do they enhance safety, they also avoid waste. On the subject of service life and mileage, the Group also has special tire rubber masterbatches in its portfolio that make the retreading of tires easier. That also saves valuable raw materials. Finally, the use of particularly abrasion-resistant grades of rubber in the tread contributes to good environmental performance, because they not only extend the service life of the tire, they also help reduce the fine dust problems in our towns and cities.

Efficient and ecological mobility, particularly in large cities, is among the greatest challenges of the coming decades.

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