

Polyurethane (PU) wheel treads keep roller coasters on track

### Safely through the loop at full speed

- **Material and design model for predicting wheel performance**
- **Superior dynamic properties compared to rubber**
- **Long service life with Adiprene LF pPDI**

**Cologne** – They are the main attraction at any amusement park and provide thrills galore. Some avoid them, others can't get enough of them. We're talking about roller coasters. The latest roller coasters frantically whiz around their circuits at over 230 kilometers an hour. No wonder that the wheels are high-tech – they have to be able to withstand extreme stresses. "We have added tailor-made products to our Adiprene LF pPDI PU prepolymers that reliably meet the requirements of the latest roller coasters in terms of dynamic stress, material fatigue, grip, abrasion resistance and roll resistance," says Gerald King, head of Application Development and Technical Service for Europe in the LANXESS Urethane Systems business unit. "We have also developed a material and design model with our US colleagues that allows us to predict the characteristics of the wheels and treads and thus support our customers in their material selection and design."

### Securely fixed to the track

It is the suspension that keeps roller coasters safely on the track. This usually consists of three pairs of wheels per axle, which keep the roller coaster car fixed to the track in all directions. The running wheels allow the car to move on the track. The side friction wheels prevent the car from derailing in tight curves as a result of centrifugal forces. The up-stop wheels hug the bottom of the rail and ensure that the car does not lift off the track.

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### **Hardly any heat produced during cyclic deformation**

Due to its dynamic properties, synthetic rubber cannot withstand the high acceleration and braking forces acting on roller coaster wheels and is therefore not used for the treads. By contrast, Adiprene LF pPDI hot-cast elastomers are characterized by excellent dynamic performance. They create hardly any heat during frequent, rapid deformations (low hysteresis), so the wheel treads do not overheat during continuous operation. This makes them better able to withstand the loads, and the wheels roll exactly at the intended speed. "The PU elastomers show excellent abrasion, tear and cut resistance, which together with the dynamic characteristics ensures long wheel life," says King. "This also benefits sustainability because PU elastomers can be recycled into thermoplastic polyurethanes in current test trials and thus contribute to closed material cycles."

### **Excellent industrial hygiene, controllable viscosity**

Adiprene LF pPDI is manufactured using Low Free (LF) technology. The prepolymers therefore contain less than 0.1 percent free isocyanate monomer and meet the latest regulatory standards for health, occupational safety and environmental protection. "The processor can handle them more easily and do without costly protective measures," says King. With LF prepolymers, the polymer morphology can also be more precisely controlled, resulting in a highly structured phase separation between crystalline hard and amorphous soft segments. This is reflected in better physical and mechanical properties of the elastomer parts. Furthermore, the molecular weight distribution is narrower and the physical cross-linking more pronounced. "The viscosity of the prepolymers can be varied widely at a constant isocyanate content and adapted to processing conditions, equipment and desired product properties. In many cases, solvents can be dispensed with when formulating reaction systems," explains King. Urethane Systems is the only manufacturer worldwide to offer PU prepolymer systems based on

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pPDI (*p*-phenylene diisocyanate) with low levels of free isocyanate monomer.

### Wide application potential

The new Adiprene LF pPDI prepolymers are also suitable for other extremely stressed wheel treads and wheels. “There are good opportunities, for example, with tires for forklift and order-picking vehicles, guide rollers for high-rise and industrial elevators, and wheels for agricultural machines or in-line skates,” says King. Other possible applications include screen printing squeegee blades and coupling stars.

LANXESS is a leading specialty chemicals company with sales of EUR 7.2 billion in 2018. The company currently has about 15,500 employees in 33 countries and is represented at 60 production sites worldwide. The core business of LANXESS is the development, manufacturing and marketing of chemical intermediates, additives, specialty chemicals and plastics. LANXESS is listed in the leading sustainability indices Dow Jones Sustainability Index (DJSI World and Europe) and FTSE4Good.

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## News Release



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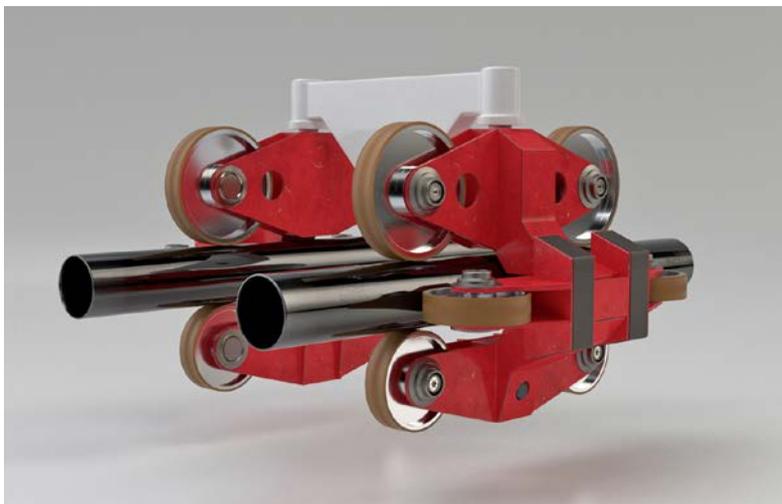
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### Images



Polyurethane wheel treads based on Adiprene LF pPDI keep roller coasters safely on track, even under extreme conditions.

Photos: LANXESS AG

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