News Release

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A chair from the virtual world

- **Belleville – The new plastic design chair from Vitra**
- **Simulation innovation: Real shape of gas bubbles taken into account for the first time in a structural simulation**

The new design highlights in the world of chairs from Vitra, the Swiss furniture manufacturer, are called Belleville. Vitra launched the product range, consisting of the Belleville chair and the Belleville armchair, as well as the accompanying tables, at the Milan Furniture Week this spring. The products were designed by the French designer duo of Ronan and Erwan Bouroullec. The new chair creations consist of two separate components: the frame structure and the seat shell. Both are made of the polyamide Ultramid® B3EG6 SI from BASF and were developed with the assistance of the Ultrasim® simulation instrument. The slight and elegant frame, which simultaneously fulfills the highest stability requirements, demonstrates the design's technical refinement. The chair will be on display at BASF's stand at Fakuma (hall B4, stand 4306).

The Belleville chair

In the development of the new chair, whose name is taken from the artist's quarter of Belleville in Paris, Vitra sought a plastics manufacturer that not only had the requisite material expertise, but also know-how in the field of virtual component design.

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With its weather- and UV-resistant material Ultramid® B3EG6 SI (surface improved), BASF was not only able to meet the demanding requirements in terms of mechanical strength; the polyamide also proved itself highly suitable due to its excellent surface quality and almost unlimited color possibilities through coordinated Masterbatches from BASF Color Solutions.

“This comprehensive package of product and services was the decisive factor in choosing BASF as our partner in carrying out this project,” said Thomas Schneider, Project Manager Innovation Team Seating, Vitra AG.

Virtual simulation

Virtual simulation is an increasingly important element in designing components and tools. Ideally, the entire manufacturing process can dispense with real prototypes. Component geometry can be optimized, and the precise dimensions of tools determined, prior to production. For furniture manufacturers, this results in significant cost and time savings in the development of a new design.

BASF has already proven its CAE (computer-aided engineering) expertise in numerous projects, for example the MYTO cantilever chair from Konstantin Grcic and the A-Chair from Brunner, both of which were produced with the conventional injection molding procedure.

The Belleville, by contrast, was to be manufactured using the more complex GIT (gas-injection technology) production method. In this method, after the conventional injection molding process an inert gas (usually nitrogen) is injected into the shape that works something like an internal structural element, displacing the melt and creating a hollow space.

Vitra opted for this production method because it enables substantial material savings while achieving the same component stiffness. Thus in comparison to conventional injection molding, the method enables more economical and lighter design variants. At the same time, however, the technology presents extremely demanding

requirements in terms of calculating component geometry, as the size and position of the gas bubbles have a significant impact on the strength of the chair.

The GIT must therefore be taken into account at an early stage and with great reliability in designing the injection molding form, not at least because the costs of tool modifications are significant.

First structural simulation with real gas bubble shapes

Generally, the gas-injection technology is only accounted for in an idealized form. The size and shape of the gas bubbles are estimated and inserted into the CAD drawing. However, these simplifications are associated with significant uncertainties and frequently represent substantial deviations from reality. Components subjected to significant loads, such as chairs, which are intended to appear sleek and elegant, have to be overdimensioned to account for these uncertainties. The potential of the design, process and materials is not fully exploited.

In designing the Belleville, BASF used the Ultrasim® simulation tool to account for the actual shape of the gas bubbles for the first time in a structural simulation. In a realistic process on the computer, first the component is volumetrically filled with melt; in a second step, the gas is injected, forming a gas bubble as in the actual injection molding process. The internal geometry generated through the process simulation with GIT is then used for the strength calculation in the structure simulation.

“In contrast to the idealized process, this process precisely takes account of areas of differing wall thicknesses, rounding and transitions,” says Błażej Paluszyński, an Ultrasim® expert at BASF. “The precision of our calculations was demonstrated in a cross-section of the manufactured chair frame. It reflected the simulation results with great precision.”

On the Internet:
www.ultramid-si.com
www.ultrasim.basf.com

About BASF Performance Materials

BASF's Performance Materials division encompasses the entire materials know-how of BASF regarding innovative, customized plastics under one roof. The division, which is active in four major industry sectors – transportation, construction, industrial applications and consumer goods – has a strong portfolio of products and services combined with a deep understanding of application-oriented system solutions. The major drivers of profitability and growth are our close collaboration with our customers and a clear focus on solutions. Strong capabilities in R&D provide the basis to come up with innovative products and applications. In 2014, the Performance Materials division posted worldwide sales of € 6.5 billion. More information at: www.performance-materials.basf.com.

About BASF

At BASF, we create chemistry – and have been doing so for 150 years. Our portfolio ranges from chemicals, plastics, performance products and crop protection products to oil and gas. As the world's leading chemical company, we combine economic success with environmental protection and social responsibility. Through science and innovation, we enable our customers in nearly every industry to meet the current and future needs of society. Our products and solutions contribute to conserving resources, ensuring nutrition and improving quality of life. We have summed up this contribution in our corporate purpose: We create chemistry for a sustainable future. BASF had sales of over €74 billion in 2014 and around 113,000 employees as of the end of the year. BASF shares are traded on the stock exchanges in Frankfurt (BAS), London (BFA) and Zurich (AN). Further information on BASF is available on the Internet at www.basf.com.