



## Wide spectrum

### BASF polymers in automotive applications

Plastic add-on parts for the car body such as fenders or trunk lids made of a special polyamide that can be coated online (figs.: BASF)

At a trade press conference held in advance of K 2007, BASF took advantage of the opportunity to introduce their latest innovations that are to be presented to visitors to K. As far as the automotive sector is concerned, there are a number of features on offer. The spectrum ranges from a glass-fibre-reinforced PBT/ASA blend for hard-soft combinations to an impact-modified, mineral-filled, partially aromatic polyamide for online coatable car parts. In our next issue (Polymotive 09+10/2007), we will be looking at what BASF can offer in the field of simulation methods.

#### The Dolphin method

Entailing only minor limitations to design freedom, the Dolphin method (see Polymotive 05+06/2006) works considerably faster and more cost-efficiently than conventional methods. As a result, panelling that is soft to the touch and that has an upscale appeal is now available for automobile classes that until now had only been fitted with coated, hard injection-moulded parts. The Dolphin

method can create various fine, leather-like surface structures using Ultradur S as the material. This technique can also be used to make undercuts without any problem; all one has to do is move a slide bar along the tool opening.

The Dolphin part owes its toughness and stiffness to the support made of Ultradur S 4090 GXI High Speed. This product variant, which was tailor made for the Dolphin method, is based on the tried-and-true Ultradur S 4090 GX, a glass-fibre reinforced PBT/ASA blend, and it was specifically optimized for instrument panels and other parts in automobile interiors. The abbreviation GXI stands for enhanced low-temperature impact strength, a property that is particularly important for the crash behaviour of instrument panels. The term High Speed indicates the very high flowability, which is achieved by means of a special nano-additive. This high flowability shortens the production times and offers greater design freedom. In comparison to PP, which is often employed as the support material for instrument panels, the PBT/ASA blend offers higher thermal endurance, allows thinner walls and provides inherently better adhesion to the soft component.

The base product is a particularly low-warpage member of the Ultradur group. This property can be ascribed to the ASA domains (ASA: acrylonitrile-styrene-acrylate copolymer) in the blend, which ensure

that the geometry of the component is fully retained when the moulded part cools off. The second advantage of the ASA domains is that they act as nucleation points for gas bubbles in the MuCell foaming process, so that Ultradur can also be expanded effectively and homogeneously. In this process, the nitrogen bubbles tend to form at the boundary layer to the ASA component and help the latter in reducing warpage. Without ASA, the nitrogen bubbles would be formed on the glass fibres and would severely impair their main function, namely, force transmission, as is the case, for instance, with PP. Therefore, it is thanks to the ASA domains that foamed Ultradur actually has a better elongation at break value than the non-foamed material while also being 20 percent lighter in weight. Just a few modifications to the machine configuration are sufficient to take advantage of this aspect in the Dolphin method in order to reduce even more weight in the support material.

#### First prototypes

One year after the introduction of this concept, BASF is now already working on the first projects for customers. Scania uses the Dolphin method to make the first prototypes of the upper part of an instrument panel for trucks. Moreover, the company Engel will perform a live demonstration at the K show (see page 34).

### Machine and tool concept

The new installation on the basis of the Duo Series made by Engel and developed specifically for the Dolphin method comprises two coupled injection-moulding units. After the Ultradur support has been injection-moulded, the tool turns and is withdrawn from the first unit, so that the support can be foam-encapsulated in the second unit - an injection-moulding unit with MuCell installation - with Pibiflex (a thermoplastic polyester made by P-Group), which has been mechanically blown with nitrogen. The Swiss company Georg Kaufmann Formenbau has created a moving platen tool for this purpose. The new Dolphin method was first introduced in May 2006 and is being jointly marketed by the four partners that contributed to its development. In comparison to the conventional manufacture of multilayered foamed parts, it is not only considerably faster and cheaper but it also reduces the complexity, thus yielding logistical advantages.

### Plastic specialty for online coatable car parts

Ultramid Top 3000, an impact-modified, mineral-filled, partially aromatic polyamide, was created as a new product class in the realm of thermoplastic solutions for online coating. This material meets the demand for weight reduction made by car manufacturers and promotes the trend towards individualization and greater variety while also offering cost advantages. Only through the design freedom that such plastic solutions afford will the visions of car designers have a chance of becoming a reality in the future.

The outstanding property of the new plastic is its considerably lower coefficient of thermal expansion (CTE), which ensures dimensional stability even at elevated service temperatures. Thanks to its very high thermal stability, this material can also be used in coating and drying processes even at temperatures just above 200°C (392°F). The high stiffness of Ultramid Top 3000, which is retained even when it is moist, gives the components greater and tangible sturdiness. Moreover, the material absorbs water

considerably more slowly and also releases it more slowly. The dimensional changes associated with this are likewise delayed, so that it is less sensitive to climate fluctuations.

### Easy processing by nano-technology

The latest findings in nano technology have also been incorporated into the development work. This technology ensures a high flowability and thus allows easy processing by means of injection moulding. In spite of many experiments and measurements involving test specimens, an exact prediction of the crash behaviour of the plastic is very complex and is only possible with the assistance of state-of-the-art simulation methods. The numerous influencing parameters such as the geometry of the component, processing and surface coating, however, make it necessary to ascertain the individual crash behaviour on the coated component itself. In any case, fender benders are a thing of the past when plastics are employed for exterior parts.

The process as a whole should be looked at in assessing how the plastic can be coated. The discharge capacity of the material alone must not be a criterion. It is much more appropriate to consider each coating process individually. The coating result is decisively dependent on the coating technique and coating system used. It has already been possible to successfully coat Ultramid Top 3000 in Class-A quality in various coating lines under different conditions and coating concepts.

This plastic will be particularly successful in entering serial automotive production if the injection-moulded parts, like sheet metal, are installed in the raw frame and then move through the entire manufacturing process, if at all possible without requiring any additional work. This specialty will be officially introduced at this year's K trade fair.

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The IAC company uses the Dolphin method to make the upper part of a truck instrument panel for the Swedish truck manufacturer Scania.