Driving towards better economy

The control elements in the interior of the Hyundai "i-mode" concept car have a pleasant touch due to a soft-feel PU coating by Bayer

When the global economy crunched during the "Great Recession", the automotive sector is one of those industries worst hit during the financial fall-out. Today, more than ever, automakers and their suppliers are pressured to develop new methods to save costs and energy. *APN* reports on some new – and improved – features we can expect this year

Being able to mould one or more materials on a main part in a single step is a direct way to improve cost efficiency. **Bayer MaterialScience** achieves this for the first time with an aliphatic PU material in the series production of vehicle interior parts.

Using a new production process called DirectSkinning, Bayer and fischer automotive systems developed a decorative panel that is now manufactured in series production. The component seals off a kinematic drawer located on the dashboard of the BMW 5 Gran Turismo series, directly above the central console.

The covering – with thickness about 1.4mm – is moulded onto the thermoplastic substrate made of heat- and impact-resistant polycarbonate acrylonitrile-butadiene-styrene (PC/ABS) blend. The PU system used on the cover is Bayflex LS (Light Stable) from BaySystems, the umbrella brand for the PU systems operations of Bayer MaterialScience. Specially developed for the DirectSkinning process, the system produced panels in five colours, including ivory white, light beige and gray.

"Our PU systems meet the growing demand for light colours in vehicle interiors as they deliver lasting UV resistance and colour fastness," said Gregor Murlowski, a PU expert at Bayer.

He added: "They give the surfaces a high level of scratch and abrasion resistance."

According to Bayer, DirectSkinning technology combines injection moulding of thermoplastics with the reaction injection moulding (RIM) process for PU processing. The coated component is produced directly on the injection moulding machine in a single mould (multiple moulds are said to be possible) in a process that is similar to multi-component injection moulding.

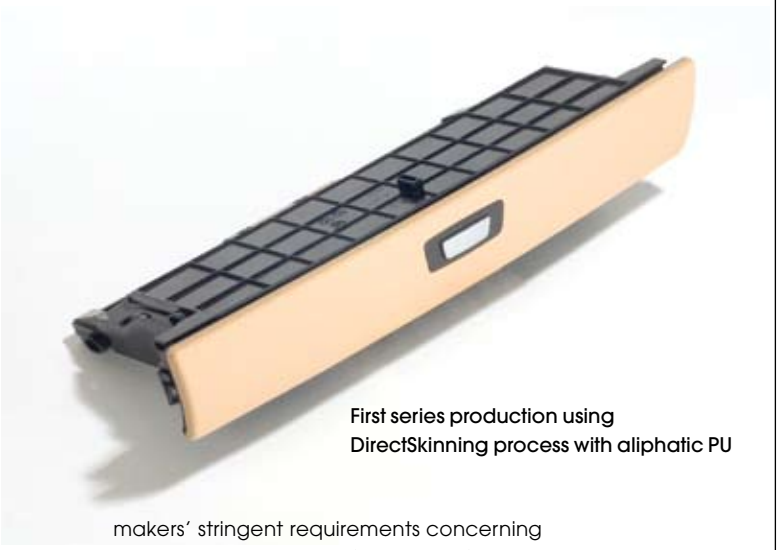
The thermoplastic substrate is first injection moulded and the PU system is injected into the closed mould via a PU mixing head and the thermoplastic surface is thus coated.

"When a rotary table or swivel platen mould is used, the two production steps can be performed in parallel, for example, thus ensuring short cycle times and high productivity," said Andreas Bürkle, who is in charge of the DirectSkinning project at fischer automotive.

Another advantage of this process is that the finished parts require little secondary finishing. The thickness and colour of the PU layer can be varied over a broad range. As the component is produced in a single mould, DirectSkinning does not require a separate coating system, unlike traditional methods.

"The investment and space needed for the machines are reduced accordingly… simplifying logistical processes and minimising the risk of contamination and damage," said Rainer Protte, who is responsible for the development of special injection moulding processes at Bayer MaterialScience.

In addition, the light stability of the decorative panel's PU surfaces was extensively tested. This included heat ageing, hot-light ageing, climatic change and solar simulation testing. Testing showed that virtually no surface defects, discolouring, yellowing or hardness fluctuations occur over the service life of the component, thus satisfying auto-



First series production using DirectSkinning process with aliphatic PU

makers' stringent requirements concerning the yellowing stability of plastic surfaces in vehicle interiors.

It was also possible to map the mould, whose surface has a leather-like grain, adapt the PU surface exactly to the colour specifications and match its optical effect precisely to neighbouring surfaces made from other materials.

Beauty on the inside

Over at Opel, a new Softell polypropylene (PP) compound from **LyondellBasell** is being used to manufacture a variety of large, visible interior applications such as the instrument panel and the door panels of the new Astra model.

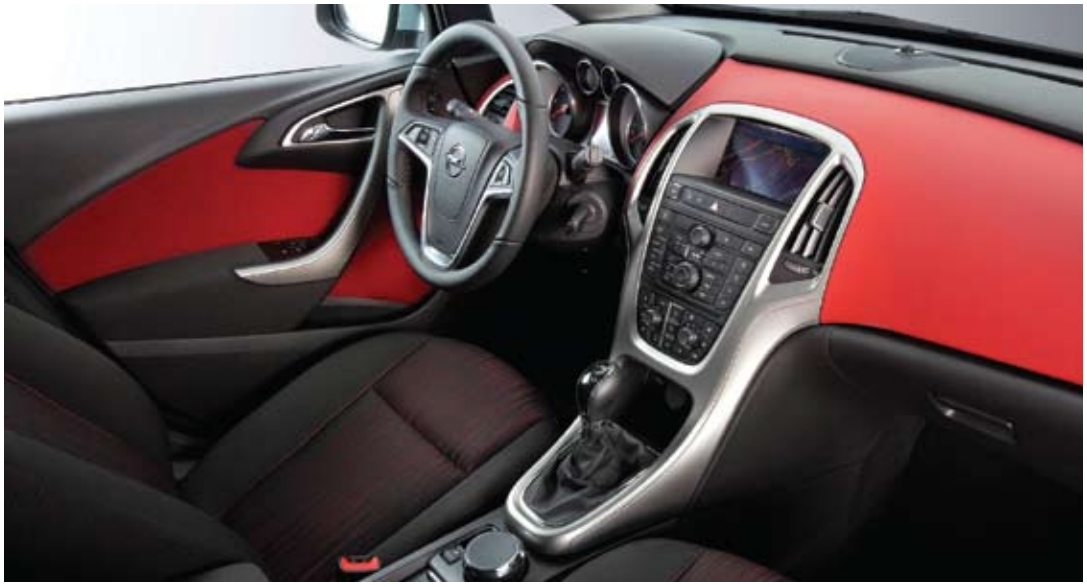
"This is the first time that our new Softell grade has been selected to produce visible, highly aesthetic interior parts in a compact and mid-range model," said Michael Pohl, European automotive business development manager at LyondellBasell.

Other polymers such as ABS with soft-touch painting have dominated interior applications in compact and mid-size car models. Surface properties offered by Softell resins allow manufacturers to produce interior parts with surface aesthetics and soft-touch qualities without the need for painting.

"The Softell PP compounds used in the Astra interiors have established new aesthetic and resource-efficiency benchmarks for mid-size automotive models," said Pohl.

The gloss level of a conventional PP compound is between 2 and 3 GUs (measured at an angle of 60°). Tests conducted using a gloss meter show that Softell resins have a gloss level below 1.5, which is required to achieve good matt surface characteristics without additional painting processes.

Besides surface aesthetics, the Softell resins also offer improved scratch resistance, which is essential for today's demanding automotive interior applications. Scratch-resistance tests showed that at 10 N, Softell resins have achieved a much higher level of scratch resistance compared to standard thermoplastic polyolefins.



LyondellBasell's Softell PP compound is used for instrument panel, the B and C pillars and the door panels of the recently launched new Opel Astra model

"LyondellBasell trials conducted on several different grains showed that the finished parts produced with Softell resins demonstrated a gloss level up to three times lower than finished parts produced with a standard scratch-resistant PP compound," explained Pohl. "Mar resistance was almost twice as high as that of standard PP compounds."

The Opel Astra's visible interior components produced using Softell resins also show better surface hardness, compared to competitive materials. Furthermore, these parts have improved recycling potential, since the coating that is typically required with the use of other thermoplastics is eliminated.

Space for spare

When a material like highly reinforced polyamide 6 (PA6) meets the automotive industry's demands for stiffness and strength, plastics become a viable alternative to sheet steel, aluminum and glass-mat-reinforced thermoplastics (GMT).

Reinforced PA6 is used to produce spare wheel recess with integrated reinforcing channels in the new Audi A8.

Injection moulding allows the complex geometry of the part and direct integration of other functions onto the part to be achieved easily. If sheet metal is used instead, more production space is required and incorporating other functions would require a large number of separate production and assembly steps, not to mention all the associated costs.

The recess is made of **Lanxess**' Durethan DP BKV 60 H2.0 EF, a highly filled PA6 with 60% glass fibres, by voestalpine Plastics Solutions, a company based in the Dutch town of Putte.

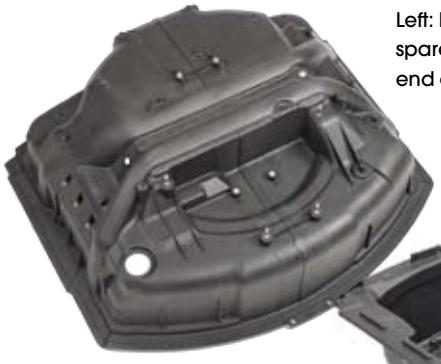
At 100 x 85 x 32 cm, the spare wheel recess is unusually large for an injection-moulded part. The substrate alone weighs about 9 kg. The component is bonded and bolted to the body framework, and fulfils the additional function of reinforcing the rear end of the car. This is achieved by integrating two reinforcing channels, each around 2 m long, using gas injection technology (GIT).

The PA6 makes a major contribution to the high overall stiffness. Its tensile modulus of about 19,000 MPa at ambient temperature (conditioned: 13,000 MPa) is twice that of a standard PA6 filled with 30 % glass fibres. It also retains its stiffness at high temperatures – as required by Audi for components located close to the exhaust system, for example. Stiffness and strength are also important requirements because the recess supports numerous fittings and attachments weighing a total of around 70 kg. These include the spare wheel, air spring compressor, vehicle jack, tools, battery and various control units. The battery is attached to an aluminum sheet that is integrated in the component. This stops it from becoming detached in the event of a rear-end collision.

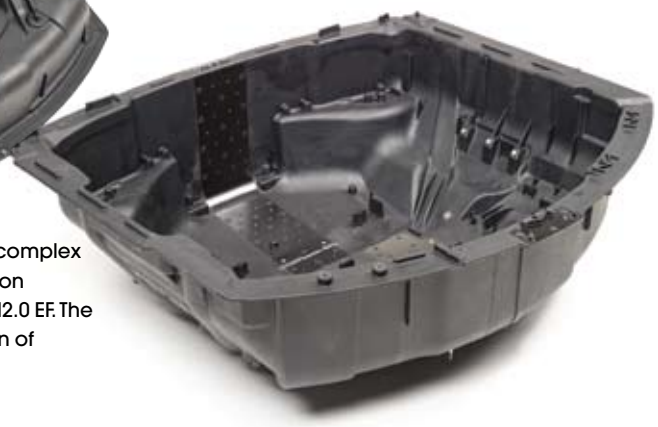
The spare wheel recess is made in a single-stage injection-moulding process. Particular challenges include the size and 3D complexity of the moulded part, the high shot weight of around 12 kg, precise back-injection of the aluminum sheet for the battery and integration of the GIT process for the reinforcing channels. Precise metering is achieved using a 2,700-tonne injection moulding machine with a screw that has a relatively large diameter of 15 mm.

Production of the part begins with the PA6 injected into the mould. The highly filled material's excellent flowability – similar to that of a standard PA6 with 30% glass fibres – means that only two gates are required. The GIT process is then used to produce the reinforcing channels, the excess melt being forced into overflow cavities.

"Our material makes thin walls possible. What's more, the expelled melt can be returned to the process as a recyclate at a ratio of 30%," said Markus Hildebrandt, a GIT expert at Lanxess.



Left: In addition to its principal function, the spare wheel recess also reinforces the rear end of the car



Right: The spare wheel recess's complex geometry is achieved by injection moulding Durethan DP BKV 60 H2.0 EF. The PA6 also allows direct integration of numerous functions