

Autonomous driving, advanced interfaces and the circular economy

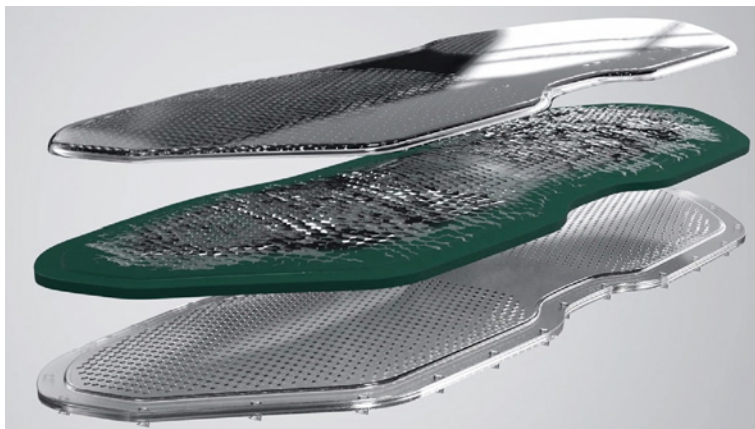
Stunning optical effects and advanced human-machine interfaces with decorated plastics were on show at the K 2019 plastics industry fair. **David Vink** looks at some of them, and how decorated plastic parts can contribute to the circular economy

At the K 2019 stand of decorative foil producer Leonhard Kurz, the highlight was the “world premiere” of an IMD PUR process for in-mould decoration with preformed silk-screen decorative foil printed on both sides, followed by post-moulding flooding with polyurethane in thickness between 0.3mm and 15mm over the foil-decorated surface. The entire process took place within the clamping unit in the production cell on the Kurz stand.

The PUR coating creates an optical impression of depth, a high-gloss surface with high stone-impact resistance and self-healing after scratching, with no impairment to underlying decoration.

According to Kurz, its IMD PUR process differs significantly from other PU flooding processes. Describing it as a “technological quantum leap”, the company noted that it is the first time such a one-step process had been shown with the use of the IMD in-mould decoration process otherwise known as film insert moulding (FIM). While the demonstration used PMD (Print Mold Design) placement of single sheets in the mould, Kurz said roll-to-roll IMD technology can also be used as a basis for IMD PUR.

ClearMelt technology is another example of a PU flooding technique, in this case developed by injection moulding machinery producer Engel. The technique was shown for the first time at an Engel open house event in



IMD PUR process layers, from top to bottom, polyurethane, film décor, polycarbonate

Schwertberg, Austria in 2009. Hennecke, which supplied the PU equipment then as a ClearRIM wood and plastics coating system was also involved with the IMD PUR demonstration on the Kurz K 2019 stand, but with Streamline Mk 2 equipment this time round.

Crystalline optics

There was also a difference in the material base selected for the IMD PUR demonstration by Kurz at K 2019, with clear Sabic polycarbonate used as the base moulding material, instead of the opaque PC/ABS blend used at the first ClearMelt demonstration back in 2009. Use of a transparent PC made a marked contribution to the “ground-breaking crystalline-like design” optics of what was being touted as a “futuristic front panel for autonomous driving”.

The production and PUR flooding of injection moulded parts in a single machine pass is a known process. The novelty, however, is in combining this with the IMD process, creating an optical effect that may be considered to be the most innovative and impressive aspect of the Kurz demonstration. The specific effect on show was developed by Burg Design, which has been involved in ClearMelt projects with Engel since 2009.

The panels were produced at K on a 246-tonnes hydraulic Engel Duo 2460/900 injection moulding machine. “Creative moulding solutions” mouldmaker Schöfer, located near Engel in Schwertberg, supplied the mould tool for both the Kurz K 2019 demonstration and the 2009 ClearMelt demonstration, among other occasions. Its activities became integrated within Leonhard Kurz in 2018,

when Kurz became one of Schöfer’s shareholders.

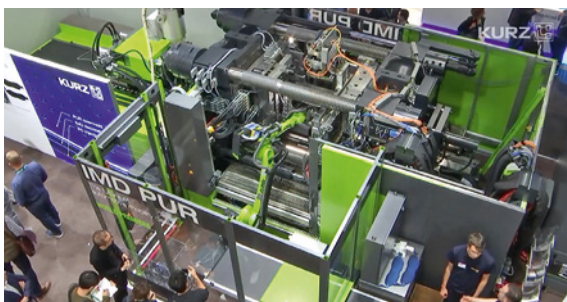
Aside from the “futuristic” front panel at the K fair, Kurz says it sees potential for crystalline optics derived from the IMD PUR process in autonomous driving front “grilles”, as an example of how the sophisticated lighting design concepts common in automotive interiors are now also moving into exteriors.

Autonomous vehicles require materials permitting both light detection and ranging (LiDAR) and radar beams to pass through to sensors contained within solid front panels. These can also have visual appeal, such as a gradient from black to blue, or a “metallic-like” reflective colour alternating with a saturated green, but which becomes deep blue with changes in incident light. Backlighting further emphasizes these effects by making the internal structure more visible through the PU coating.

Recycling / sustainability

At Fakuma 2018 and again at K 2019, Engel demonstrated the Kurz IMD Varioform process with its easy change-over from one roll-fed foil to another in order to apply different decors. As before, it partnered with Isosport Verbundbauteile in this Engel “Foilmelt” process, involving roll-to-roll foil die-cutting & thermoforming and back injection in the mould as a single-step process. New, however, was the use of Trexel’s MuCell micro-cellular physical foaming process and Riablend recycled PC/ABS from Ria Polymers.

Engel also mechanically recycled (ground) the parts for 10% use together with virgin plastic in the production of new ones. Kurz described



Bird's eye view of the IMD PUR production cell at K 2019

this as a good example of “holistic design for recycling” and pointed out that the range of decorative options with recycle were the same as with virgin plastics and that the use of recycle yielded products with aesthetic properties that matched those made with virgin material alone.

As the decorative film used in IMD Varioform remains on the moulding at the end of life, the film type is adapted to the polymer substrate. As Kurz says: “The film is easy to recycle, as it is very thin”.

Dr Astrid Rauth, Kurz R&D engineer responsible for recycling, gave one of the forum presentations at the VDMA association of German plastics & rubber machinery producers’ pavilion at K 2019, about how the recycling of decorated technical parts and their use in new decorated parts contributes to the circular

to recycle, as it is just the decorative coating that is transferred to the part.

Firstly, both 10% and 25% material recycled from other decorated parts were used with 75% and 90% virgin polymers, and the mechanical and optical properties evaluated. The work was then repeated, taking the recycled plastic and re-using it with virgin polymer to produce decorated automotive trim parts in up to four life cycles. Gloss measurement measured at a 60° reflection angle achieved the same 89 gloss units (GU) result, irrespective of the decorated trim being produced in virgin polymer or 100% recycle.

Human-machine interfaces

Engel demonstrated the use of Clear-Melt at Fakuma 2010 to incorporate capacitive circuitry for touch sensors from Plastic Electronic under a high gloss black PU layer in a centre console type of application produced with a Schöfer two-component rotating index platen mould. Engel said at the time that “A cockpit of the future without buttons and switches will be just as elegant as smartphone controls”.

And there is indeed a movement in that direction. Aside from IMD PUR and IMD Varioform demonstrations, Kurz talked at K 2019 about 10 different innovative approaches shown at the fair, with a distinct emphasis on human-machine interfaces (HMI).

At the stand of Sumitomo (SHI) Demag, an automotive instrument panel was being moulded on a new all-electric IntElect 500 injection moulding machine. For the first time, a single-frame decoration was applied by IMD up to a side length of 1,000 mm. PolyTC single-layer flexible metal-mesh capacitive dead-untillit touch sensor technology from Kurz’s PolyIC subsidiary were applied by IML, providing integration of one slider and three button functions.

Polycarbonate was injected between IMD and IML decoration, forming a part weighing 350 grams, moulded with cycle time below 60 seconds, including UV curing, brush cleaning and laser marking a dot matrix code (DMC). SHI Demag described the application as “the largest IMD/IML automotive instrument panel [IP] with integrated HMI functionalities”.

A steering wheel demonstrator shown on both the Kurz stand and that of decorative parts moulder Kunststoff Helmbrechts (KH), in slightly different versions, was produced for the automotive electronics development company GE-T. It showed how separate switch and control functions are increasingly being grouped into a single and therefore more reliable con-



Headliner with advanced lighting and control features produced at K 2019 by Wittmann Battenfeld

trol panel without conventional discrete switch and control components, KH sales director Christoph Ernst told *Plastics News Europe*.

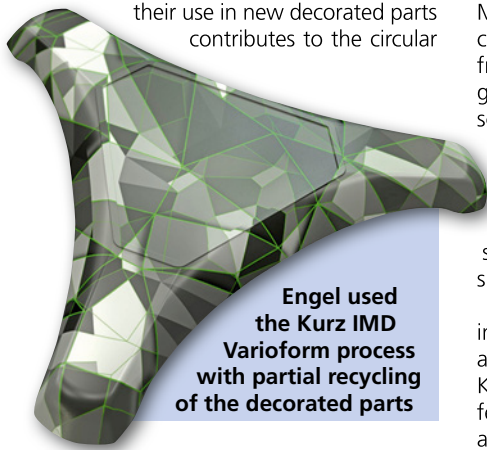
Ernst added, “Vehicles will increasingly be designed with many controls as on-screen touch functions, so much less separate discrete elements or units, irrespective of conventional combustion engine or electric drive. But on the other hand, there will be larger surface area parts to be decorated with advanced techniques and integrated functions.”

A highlight on the KH stand was a 3D capacitive touch control with haptic feedback, developed with Kurz FFB functional foil bonding sensor technology, itself based on PolyIC transparent touch sensor technology. Kurz showed a new semi-rotary technique for FFB in action, applying 8-inch sensors to home appliance trim.

FFB was developed by Kurz subsidiary Baier, and launched at Fakuma 2018, to fully mechanically bond touch sensors to plastic components outside the core injection moulding process, as an alternative to in-mould labelling them. Kurz says FFB avoids potential adhesion loss and bubble formation under climate tests when using optically clear adhesive (OCA) or pressure sensitive adhesive (PSA) to bond sensors to plastic mouldings.

Wittmann Battenfeld demonstrated Kurz’s IMD Varioform process at K 2019 with five steps integrated within each injection moulding cycle to produce a car headliner module on a SmartPower 240 XL machine: infrared heating and vacuum backing film forming, injection moulding, punching, decoration with a backlit single image design and application of 3D-formed PolyTC sensors from PolyIC.

The module was moulded in a Georg Kaufmann single-cavity tool with a partially translucent foil providing side lighting and central on/off switching, as well as dimming and LED colour control functions, all activated by integrated PolyTC capacitive sensors.



Engel used the Kurz IMD Varioform process with partial recycling of the decorated parts

economy. Kurz, she said, has set up a return and recycling system to help to reduce its customers’ CO₂ footprint.

Rauth gave “details, facts and figures” to illustrate a new Kurz lifecycle thinking approach that promises “enormous ecological potential” for automotive and other industries. She referred to a recycling study that looked at the difference between IMD-decorated automotive interior trim strips produced by IMD Varioform and those produced by conventional IMD. The latter were less challenging



Steering wheel developed for GE-T with integrated switch and control functions, shown by Kunststoff Helmbrechts at K 2019