## Aim

In modern-day design – for example in car interiors, mobile phones, kitchen appliances, TV sets etc. – consumers want high-quality decorative metal surfaces. To produce a genuine metal appearance with the characteristic cool-touch effect, plastic parts are laminated with metal sheets approx. 0.2 mm thick. Ongoing investigations at IKV already showed that a part of this kind can be produced by the back-moulding technique. With this process, the melt, which is under pressure, shapes the metal sheet, which is inserted into the injection moulding tool, in a single process. The aim is now to be able to calculate this integrated moulding process through simulation.

## Method

So far, it has been possible with the described process to shape aluminium and stainless steel sheets up to a thickness of 0.4 mm. To ensure adhesion between the plastic and the metal, the metal is previously coated with an adhesive. Together with the Institute of Metal Forming (IBF) at RWTH Aachen University, this process variant is being systematically studied and a simulation procedure developed. To do this, the individual processes of injection moulding and forming have so far been calculated and validated separately. The time-variable melt pressure from the injection moulding simulation serves as the input value for the forming simulation. The shaping of the metal through the melt pressure is similar to the process of hydroforming. Through simulation with different boundary conditions, the forming of the decorative metal surface by the melt can be calculated. During the forming process, the metal thins out locally and is consolidated as a result.

## Results / Solution

Initial results from simulation of the forming process show that it is possible to calculate the forming of structures. A comparison between calculations and experiments for aluminium and stainless steel show a high level of conformity. Furthermore, the material behaviour at critical points can also be calculated in advance.

## Prospects

Further studies will aim to link together the ABAQUS and CADMOULD simulation programs so that the local pressure and temperature distribution during the injection moulding process can also be taken into account. An improvement in the calculation results for other materials and material thicknesses is expected. The warpage of the composite component can be calculated by modifying the calculation. A combination of existing simulation programs is to be used in future also to calculate other back-moulding processes, for example with film and textiles.

## Your contact

Dipl.-Ing. Roland Mäsing
Telephone: +49 (0) 241 80-93983
e-mail: maesing@ikv.rwth-aachen.de

Test part (top) and comparison between simulated and measured material failure (bottom)