



TOOL STRUCTURING FOR HYDROPHOBIC COMPONENTS

Task

Known from nature, self-cleaning and water-repellent surfaces are the object of many studies. Often, products for corresponding applications are provided with suitable coatings, which, however, mean an additional step and additional costs. As part of a project funded by the Federal Ministry of Economic Affairs and Energy (BMWi), an injection mold should be structured so that the molded surface has hydrophobic properties. The surface to be structured is the free-form surface of the inner side of a spoon.

Method

In order for a surface to have hydrophobic properties, its properties must behave according to the so-called Cassie-Baxter state – it needs to have elevations of sufficient height spaced close to each other. An ultra-short pulsed laser was used to produce a grid of conical holes, with each hole having a width and depth of 15 µm and located at a distance of 30 µm to each other. Since the ablation process exhibits a high share of evaporation – on account of the short period of interaction between ultrashort laser pulse and material – the surface does not need post-processing, nor does it show the annular melt protrusions typical for ablation with nanosecond laser pulses.

Result

So that the component surfaces produced by the injection molding process retain their hydrophobic properties as long as possible, a 2K injection molding is used to provide the spoon with a thin layer of elastomer along its inner side. The microstructure molded in the elastomer breaks less easily under mechanical contact than a thermoplastic, which was used for the rest of the body of the spoon.

To investigate the effect of different deformation directions on the form of the microstructures, Fraunhofer ILT has processed holes on the tool surface in five areas from different directions ($\pm 30^\circ$ in the x and y directions and vertically in the middle). Here, another advantage of the elastomer appears: demoldability without damage.

Applications

For users in the plastics and elastomer processing industry, the method makes it possible to produce complex but cost-effective bionic functionalized products.

The project was conducted in cooperation with the Institute for Plastics Processing IKV of RWTH Aachen University.

Contact

Dipl.-Ing. Andreas Dohrn
Telephone +49 241 8906-220
andreas.dohrn@ilt.fraunhofer.de

- 3 Spoon with a hydrophobic surface.
- 4 Photomicrograph of the tool.
- 5 Photomicrograph of spoon surface.