



SELECTIVE LASER POLISHING

Task

Structured or grained surfaces are often required for plastic components such as automobile instrument panels. The tools used to produce these plastic components therefore have to be structured accordingly. The method most commonly used is photochemical etching. The structures are often designed to imitate natural materials such as leather or to provide a technical function. They also have to fulfill requirements in terms of touch and appearance. The new manufacturing technique of selective laser polishing (SLP) enables, for instance, only the indentations of a surface structure to be polished to create variable optical effects, meaning only the raised sections of the structure are polished on the molded component. The new method enables surfaces to be manufactured which were not possible before or which required considerable time and effort.

Method

SLP is being investigated on the basis of flat tool inserts made of tool steel 1.2343 with a wide range of different grained structures. First the complete surface is digitized using an optical sensor system with a resolution of 1040 dpi. SLP can be used with both pulsed and continuous wave laser radiation. The process involves scanning the surface in a meandering pattern while the laser beam focus is adjusted in accordance with the tool geometry. In addition, the laser power is modulated along the processing paths as a function of the existing structures (only selected areas are laser polished).

Result and Applications

By locally modulating the laser power, the gloss in selected areas of the structure is increased to create a dual-gloss effect. Depending on the selected processing parameters, the degree of gloss can be adjusted from the initial state through to very high glosses. The highest degree of gloss is achieved by means of successive processing using continuous wave and pulsed laser radiation. To demonstrate the process, a wide range of different periodic and non-periodic structures on flat tool inserts made of the material 1.2343 have been selectively laser polished, thereby providing a structure catalog for SLP. Plastic parts with dual-gloss effect were also molded from these tool inserts. At present, the processing time is approx. 30 to 60 s/cm² with a resolution of 1040 dpi. The smallest selectively laser polished structure is currently 150 µm in diameter (size of the laser beam focus). Future research work aims primarily to significantly improve the process speed (up to factor 100) and transfer the findings to 3D tools that are highly relevant in industrial applications, e.g. embossing dies or automobile instrument panels, and to test the process in an industrial environment.

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2 *Selectively laser-polished, flat tool inserts made from tool steel 1.2343 with surfaces featuring varied graining.*