3

TEXTURING FREEFORM SURFACES WITH ULTRASHORT LASER PULSES

Task

Design structures on components, such as dashboards as well as household appliances, often have to meet optical, haptic and functional requirements. In essence, etching and mechanical processes have been used for a long time to produce such micro-structures on large-sized molding tools so as to generate decorative surfaces in injection molding and embossing processes. For some time, however, laser machines have been available that provide the freeform surfaces of such molds with any textures, both seamlessly and in a large format. The fiber lasers used in these machines have pulse lengths in the nanosecond range, are powerful and relatively cheap. Because of these pulse lengths, the laser ablation, however, creates a melt, thereby limiting resolution and quality.

Method

Laser ablation with ultrashort pulses (UKP, ps, fs) can deliver pulse frequencies up to several MHz and pulse energies 10 µJ at accuracies in the sub-µm range. The process can generate structure sizes of less than 10 µm for functional component surfaces as well as design surfaces with structures of 50 - 100 µm.

While maintaining the necessary pulse energy for ablation, the technology of the ps-laser ablation makes it possible to increase the pulse rate to up to several 10 MHz. In addition, it can reach and exceed the removal rate of ns lasers when coupled with fast scanning strategies.

Result

For some time now, the five-axis machining of freeform surfaces with ultrashort laser pulses has been available for components weighing several kg. For large components, however, the current processing times are too long. Together with machine manufacturers, Fraunhofer ILT is, therefore, developing solutions to increase efficiency through multi-beam approaches or ultrafast scanning techniques.

Contacts

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

Dr. Arnold Gillner
Telephone +49 241 8906-148
arnold.gillner@ilt.fraunhofer.de

3   Brass demonstrator watch.

Fraunhofer Institute for Laser Technology ILT, www.ilt.fraunhofer.de
DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01

Annual Report 2014   **87**