Fraunhofer Institut
Werkstoff- und
Strahltechnik

Internal sculpturing of glass by subsurface laser engraving

Problem

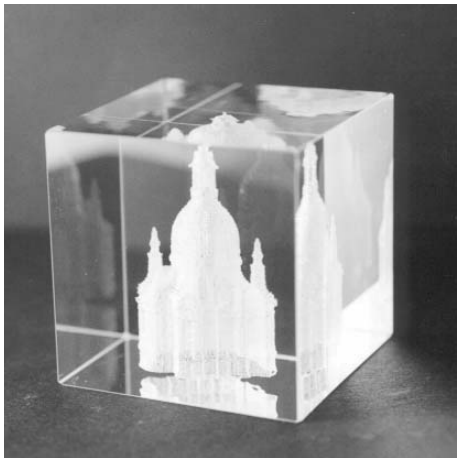
Lead crystal is traditionally engraved by cutting, grinding, and sandblasting, with the drawbacks of:

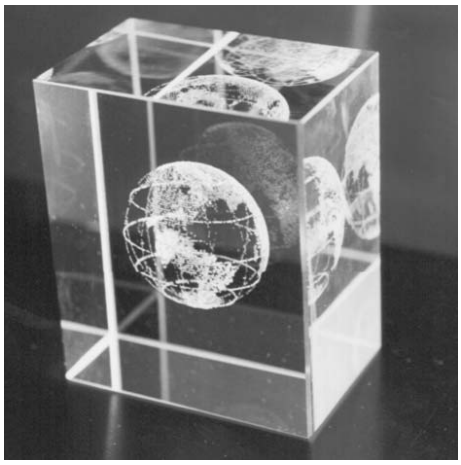
- large effort of manual labour,
- difficulty of realising small detail in writing and fine line drawing,
- environmental impact by residues from grinding, polishing, etching,
- tendency of engraved and sand-blasted surfaces to get dirty from dust and fingerprints,
- reluctance of potential buyers in view of the drawbacks.

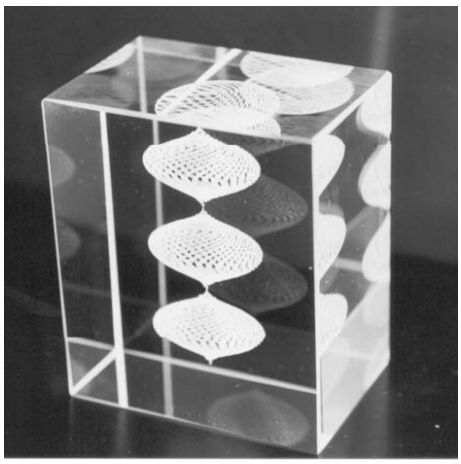
Solution

To overcome the above drawbacks, Fraunhofer IWS Dresden developed a laser technique of subsurface engraving of lead crystal. Depths up to several centimeters are covered in this way.

This gives rise to a novel manner of glass decoration: Without affecting the polished surface, two- and three-dimensional images can be created inside a lead glass block.







3D-images within optical glass blocks

Fraunhofer Institute for Material and Beam Technology IWS Dresden

(Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS Dresden)

Winterbergstr. 28
01277 Dresden, Germany

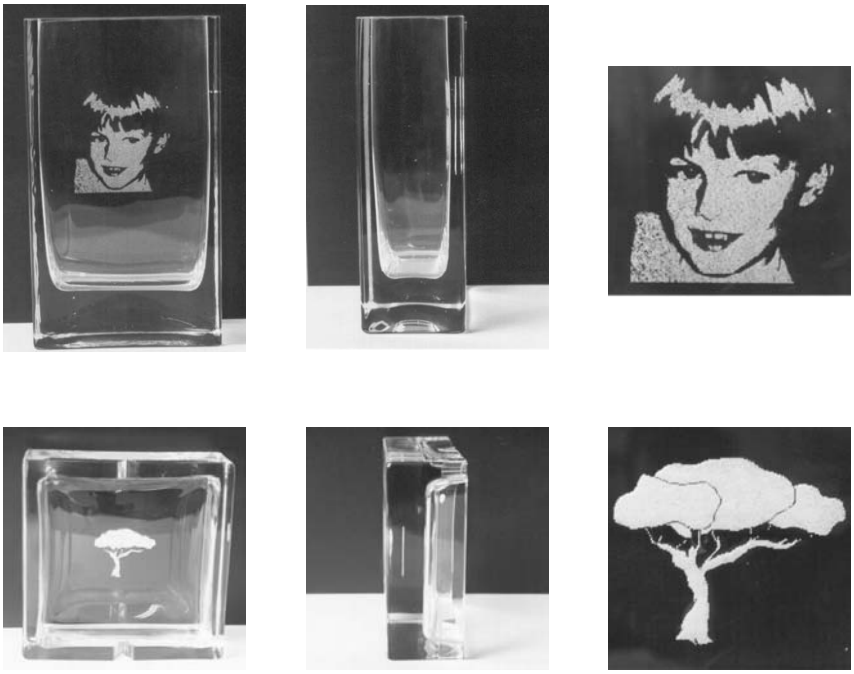
Contact person
Dipl.-Ing. Udo Klotzbach
Phone +49 (0)351 2583 252
Fax +49 (0)351 2583 300
E-mail udo.klotzbach@iws.fraunhofer.de
Internet http://www.iws.fraunhofer.de

Laser technology

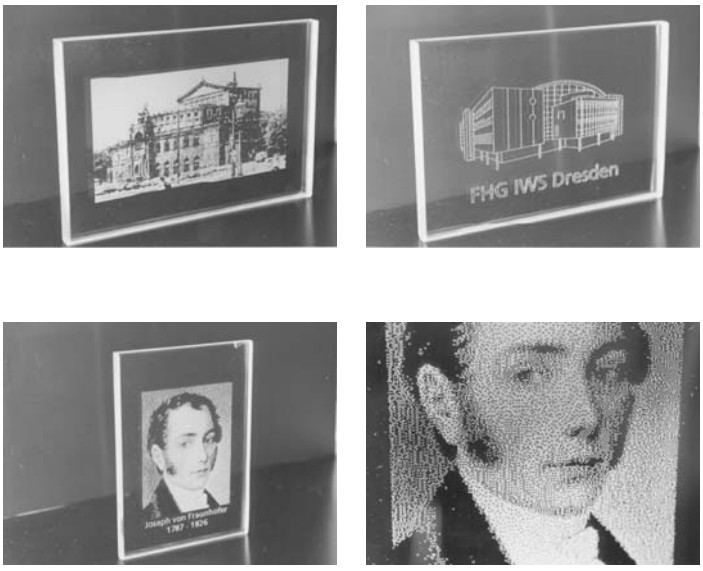
Within a normally transparent material, the high intensity in the focus of a laser beam gives rise to non-linear absorption phenomena. As a result, microscopic cracks are generated on a narrowly localised spot, which makes the spot look white by multiple light reflection.

The necessary power density of 10^{10}... 10^{12} W cm^{-2} is obtained from a special Nd:YLF-laser. This has been the first application of such type of laser to the tooling of materials.

The images are created dot by dot with the workpiece being moved in two or three dimensions. The controlled motion is based on real-time position data acquisition and processing. In this way, repetition rates up to 500 Hz are reached.



Various flat subsurface engravings within lead crystal



Pixel and vector graphics images by subsurface engraving of float glass (3 and 6 mm)

We offer

- Laser sub-surface engraving (2D) after customer's design for labelling or embellishment
- Laser bulk engraving (3D) by applying customer's data (STL-format or point sets)
- Generation of 3D data (as of model objects) by means of optical coordinate measurement
- Technological systems for laser bulk engraving (3D)