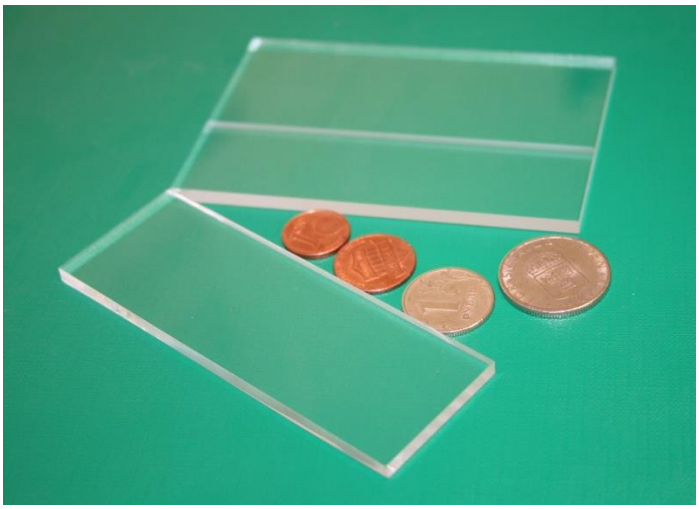
ULTRASHORT PULSE LASER PROCESSING OF GLASS

Stefan Nolte[1,2], Klaus Bergner[1], Daniel Flamm[3], Malte Kumkar[3]
[1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University,
Albert-Einstein-Strasse 15, 07751 Jena, Germany
[2]Fraunhofer Institute for Applied Optics and Precision Engineering,
Albert-Einstein-Strasse 7, 07745 Jena, Germany
[3]TRUMPF Laser- und Systemtechnik GmbH, Johann-Maus-Straße 2, 71254 Ditzingen, Germany

Ultrashort laser pulses offer a huge potential for precise microstructuring. This holds especially true for transparent materials. When focussing into the bulk material, the intensity in the focal volume can become high enough for nonlinear absorption processes leading to localized energy deposition and permanent structural changes inside the sample without affecting the surface. As this process is highly nonlinear, any optimization requires a detailed analysis and understanding of the laser-matter interaction. Therefore, we applied time-resolved microscopy and tomography to investigate the energy deposition inside the bulk material as well as the subsequent energy relaxation processes. Changing the pulse duration from 200 fs to few ps results in a completely different interaction mechanism. Consequently, not only the interaction volume is different, but also the deposited energy. Thus, different transient temperatures are obtained, leading to either more defect and color center formation or structural damage and stress. We will analyze these processes with a focus on the cutting of glasses as an exemplary application.



Single-pass cut of 4 mm soda-lime glass