

Plenary Talk

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Processing of transparent materials by ultrashort laser pulses: fundamentals and applications — ●STEFAN NOLTE — FSU Jena, Institute of Applied Physics, Jena, Germany — Fraunhofer IOF, Jena, Germany

Ultrashort laser pulses have shown tremendous advantages for precise microstructuring. This is especially true for metals, where ablation with minimal thermal and mechanical damage became possible. However, apart from simple ablation additional structuring options become possible when processing transparent materials. Especially, the realization of three-dimensionally localized modifications within the bulk of transparent materials has attracted increasing interest in the past years. When the intense ultrashort pulses are tightly focused into the

transparent material, the intensity in the focal volume can become high enough to initiate nonlinear absorption processes. This localized energy deposition results in permanent structural changes inside the sample without affecting the surface. Depending on the processing parameters, either isotropic refractive index changes, self-organized sub-wavelength structures leading to form birefringence or microvoids can be generated in the focus. In this talk, the fundamentals of internal processing of glasses with ultrashort pulses will be reviewed. The detailed understanding allows to control and tailor the interaction process in order to enable fascinating new applications. Some of them will be highlighted, ranging from the cutting of hardened glass for smartphones, the fabrication of artificial birefringent devices or specialized Bragg gratings up to localized femtosecond laser welding.