

Subsurface 3D structures by laser-induced modification of the optical properties of transparent materials

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Abstract

A new field in laser processing is opened by this method of modifying the optical properties, i.e. the refractive index, absorption- and scattering-coefficient, inside the material. Focusing ultra short laser pulses inside the transparent media allows to control and modify their optical properties. This is referred to as nik-engineering, relating the experimental technique to changes of the complex refractive index ($n + ik$). Three dimensional patterns of the ($n + ik$) modifications can be achieved in the subsurface region even on a microscopic scale. New results in nik-engineering obtained in our application laboratory are presented using different optical materials. The results in laser nik-engineering of photo-chromic glass using ultra short laser pulses at a wavelength of 800 nm are presented to the best of our knowledge for the first time. We discuss the results and the possibilities of nik-engineering and consider the technological relevance with respect to decorative work, micro-tagging, and other functional structures.