

**Laser-induced sub-surface modification of the optical properties in  
transparent materials:  
nik-engineering (TM)**

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**Abstract**

A new field in laser processing is opened by the method of modifying the optical properties, i.e. the refractive index, absorption- and scattering-coefficient, at minimal mechanical stress 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 (TM), relating the technique to changes of the complex refractive index, i.e.  $(n+ik)$ . 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 is presented. A model in respect to the relevant processes leading to the observed laser-induced modifications in the optical properties of photo-chromic glass is presented. We discuss the results and the commercial potential of nik-engineering.