SELF-ORGANIZED NANOSTRUCTURES IN GLASS IRRADIATED BY FEMTOSECOND LIGHT PULSES

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The ability to control light and properties of matter in small space regions and over short time intervals becomes more important as performances of electronic and optical devices are pushed to the limits. In this respect the use of femtosecond lasers to directly write photonic structures deep within transparent media has recently attracted much attention due to its capability for precise microfabrication in three-dimensions. Recent observations of anisotropic light scattering and reflection from the regions modified by intense femtosecond light pulses in the direction parallel to the polarization of wring laser, have given the evidence of sub-wavelength index gratings imprinted in irradiated materials. Form birefringence induced by self-organized sub-wavelength index gratings has been also proposed to explain a puzzling phenomenon of uniaxial birefringence of structures written within silica glass. Recently we reported direct proof of the existence of such gratings. Surface gratings with a period equal to the wavelength of incident light have been observed in many experiments involving laser deposition and laser ablation. The results of our work give the first evidence self-organized structures within the bulk of material. The observed self-organized periodic structures are the smallest (20 nm width) and the strongest (-0.2 index change) ever created by light in transparent materials. Moreover these are the first gratings created by light-matter (electron plasma) interference. In this paper the study of self-organized nanostructures in glasses is reviewed.