INVESTIGATION OF NON-LINEAR EFFECTS IN 3D NANOPARTICLE STRUCTURES IRADIATED BY FEMTOSECOND LASER

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The motivation of the research is based on the specific properties of noble metal nanoparticles and their wide applications. The resonance frequency for noble metal nanostructures is in the near UV and visible spectral range, where most of the commercial lasers irradiate. This makes these materials attractive candidates for efficient study and application of their properties. In this study are investigated filament formations in Au ion doped glass materials, transparent in the visible range, during the irradiation by femtosecond laser pulses. Three groups of borosilicate glasses are used - (i) samples doped with Au ions (annealed); (ii) samples with Au ions (not annealed), (ii) sample without Au ions for comparison. The second harmonic generations in the media are observed as well. This proves the formation of poly crystal structures inside the media after femtosecond laser radiation. Self-face modulation and continuum are observed. Thus, the nonlinearity of the media is higher than in the glass without doped noble metal particles. Nonlinear effects of the glass samples are investigated in terms of the laser beam parameters. The laser energy applied is between 10 and 40 μ J. The wavelengths used in the experiments are between 260 to 1200 nm, generated by optical parametric amplifier system (TOPAS). The regenerative Ti:Sapphire amplified laser system emits at 800 nm central wavelength with a pulse duration of 35 fs and 1 kHz repetition rate. Preliminary measurements and calibration of z-scan method are performed. Continuous future study is - measurements of the nonlinear refractive index and multiphoton coefficient; investigation of the relationship between the formation of filaments and local refractive index changes in glasses doped with Au ions.

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