OPTICAL LIMITING IN SUSPENSIONS OF NANODIAMONDS AND PULSE DURATION CONTROL

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Abstract

Recently there has been increasing interest in materials that exhibit strong optical limiting properties, which can be employed in particular for control of the intense laser radiation, shape and optical pulse duration, sensing and eye protection. We report on the limiting and adjustment the duration of the nanosecond pulses of the Nd-YAG laser in aqueous suspension of nanodiamond clusters, which were obtained from detonation nanodiamonds with a modified surface. By measuring simultaneously the energy of the transmitted and 900-scattered pulses on the modernized open-aperture z-scanning scheme we find that nonlinear scattering is dominating optical limiting mechanism in nanodiamond suspension, while the contribution of nonlinear absorption to the reduction of the transmission coefficient is about 25%. The nonlinear refraction does not occur. The nonlinear scattering increases while the cell containing suspension approaches the beam waist. This increasing is accompanied by a smooth change of the duration of the nanosecond laser pulses transmitted through the suspension due to cutting off the trailing part of the incident laser pulse. The increasing of the input fluence leads to reduction of the duration of laser pulses transmitted through the suspension of nanodiamonds. Suspensions of nanodiamonds with modified surface exhibit high ray stability with respect to the periodic laser action and are capable of absorbing laser pulses with high power density for a long time without changing their nonlinear optical properties.

Keywords: optical limiting, nanodiamonds, nonlinear scattering

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