OPTICAL AND NONLINEAR OPTICAL CHARACTERIZATION OF NANOSTRUCTURED POROUS ALUMINA

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A modified technique of aluminium oxidation upon exposure to air through a mercury film enables to obtain ultraporous alumina monoliths of sufficient size [1] suitable for nonlinear optical (NLO) characterization of the samples prepared. The obtained monoliths consist of tangled alumina fibers forming nanopores with an average size of 10 nm.

Due to their ultralight structure, the monoliths are very brittle. So the samples under investigation were prepared by compressing into tablets 0.25-0.4 mm thick and 13 mm in diameter, the fibrous nanostructure remaining undamaged.

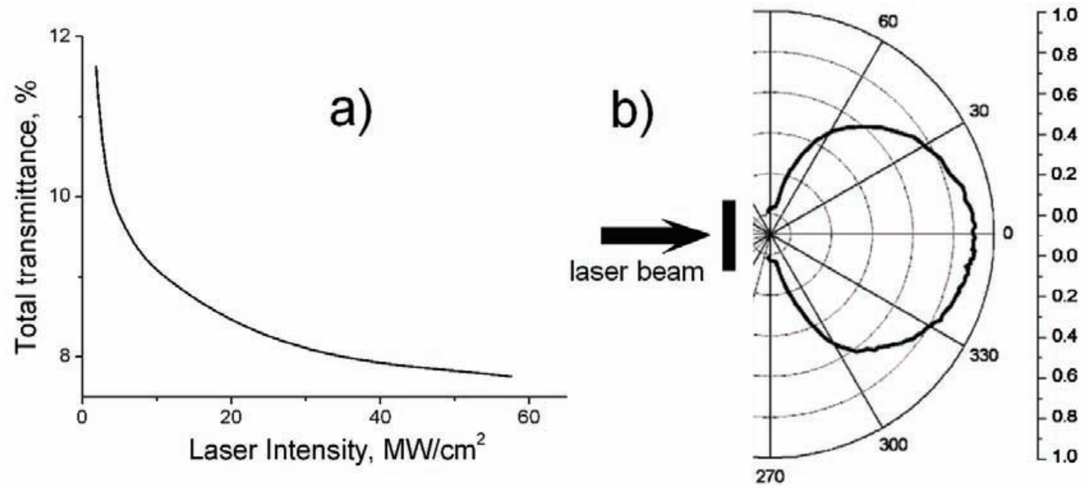

Fig. 1. (a) Total transmittance versus peak laser intensity at 1064 nm, (b) scattering indicatrix of the sample measured at 633 nm.

The NLO transmittance of the samples was measured as a function of peak laser pulse intensity at the fundamental wavelength (1064 nm) and at the second harmonic (532 nm) of mode-locked Nd:YAG laser. In the intensity range less than 10 MW/cm^2 the cubic NLO susceptibility Im($\chi^{(3)}$) ~ 10^{-7} esu was measured. The observed effect is similar to the giant NLO response of the porous layers of TiO_2 nanocrystals [2].

A scattering indicatrix of the sample was measured. The homogeneous scattering type proves that the compressing doesn't affect the fibrous nanostructure.

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References

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