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THIRD-ORDER NONLINEARITY OF SINGLE-WALLED CARBON NANOTUBES IN SOLUTION AND POLYMERIC MATRIX

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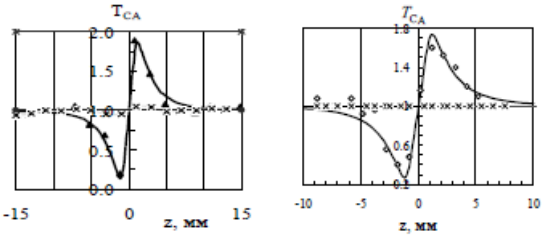
To measure the third-order nonlinearity dispersion of single-walled carbon nanotubes, we used a z-scan facility based on a femtosecond pulsed laser. Z-scan measures the intensity of lens-focused laser beam that passed through the sample moving along the beam. We measured light transmission by the sample in two modes, with aperture (hole of 0,1 cm at the center of the aperture) mounted on photodetector (closed aperture transmittance or T_{CA} regime and without the aperture (open aperture transmission or T_{OA} regime). At a high light intensity in the focal region, the space polarization acquires significant contribution of nonlinear components: the index of refraction was increasing $n = n_0 + n_2 I_0$, the optical absorption coefficient includes the linear (α_0) and nonlinear (β) terms: $\alpha = \alpha_0 + \beta I_0$.



In figures shown optical transmission T_{CA} from focal distance(z = 0): on the left – in dispertion nanotubes in TCE (crosses – T_{CA} TCE), on the right – in solid composite from PVC and SWNT(crosses – T_{CA} bottom layer from glass). Quaitity of nanotubes is 1 mg in 1 ml of solution or в 1 gr of polymer.

Calculations shown, that real component of the third-order susceptibility,$\chi^{(3)} = n_2'(n_0^2/0.0394)$, depend not from medium and take on a value $(3\pm0.1)\times10^{-10}$ esu (electrostatic units, CGSE), imaginary part – $\chi^{(3)}) = (\beta\lambda/4\pi)\times(n_0^2/0.0394) = 0.89\times10^{-11}$ esu.

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