# NANOTECHNOLOGY THE NEW HORIZON

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## Abstract

It is shown that BiB3O6:$Tm^{3+}$ glass nanoparticles (NP) incorporated into polymethylmethacrylate (PMMA) and polycarbonate (PC) polymer matrices show good second-order susceptibilities under bicolour coherent laser treatment. It is found that only during incorporation into highly polarized PC matrices could one observe an enhancement of the second-order susceptibilities with increasing laser treated power densities. The main increase is observed for all samples at power densities equal to about 0.4 $GWcm^{-2}$. After passing this value there is a saturation of the output susceptibilities and even an abrupt decrease. The most striking feature is the achievement of second-order susceptibilities equal to about 5 pm/V for samples containing 4% NP content in the PC matrix. A further increase in the NP concentration to 6% leads to a decrease in susceptibility to 15%. In the case of PMMA matrices these changes do not exceed the background. The same situation is present for the pure BIBO and low-doped Tm materials. The effect is maximal for a low concentration of Tm—about 0.75%. In the case of bulk glasses the intensity dependences of the second-harmonic generation unambiguously show that the achieved maximal values of second-order susceptibilities do not exceed 3 pm/V for 0.5% Tm concentration.

We have found that BiB3O6:$Tm^{3+}$ glass NP incorporated into the PMMA and PC polymer matrices additionally treated by dc-electric field (at electric strength about 8 kV/cm) at temperatures above the glassing temperature of the polymers show promising values of electrooptics coefficients (up to 10 pm/V at $\lambda = 633$ nm). It was established that only during incorporation into the highly polarized PC matrices one could observe an enhancement of the electroopitcs effect (EOE) coefficient with increasing time of the dc-electric treatment. The main increase was observed for all the samples at times higher than 80 min of dc-electric field treatment at temperature above the glassing temperatures of the corresponding polymers. The most striking feature is the achievement of effective electrooptics coefficient value below than 10 pm/V ($\lambda = 633$ nm) for the 4% content of the Tm doped BiBO glass NP embedded in the PC matrix. In the case of the bulk glasses the thermal poling unambiguously shows that the achieved maximal values of the electrooptics coefficient did not exceed 3.2 pm/V for 0.5% $Tm^{3+}$ concentration.