

Photoinduced effects in TiO₂ nanocrystalline films with different morphology.

Abstract

The complex studies of photoinduced absorption, second harmonic generation and third harmonic generation were performed for TiO₂ films of different morphology. In particular we have studied the influence of a bicolor laser beam treatment by a 300 mW green cw laser emitting at 532 nm on changes of absorption, birefringence and third harmonic generation on TiO₂ films. We have performed the corresponding measurements using as a photoinducing light a glass erbium 10 ns pulsed laser with a fundamental wavelength of about 1540 nm together with its second harmonic generation (SHG) at 770 nm using the method of bicolor laser treatment and a frequency repetition of about 10 Hz. Varying the power density ratios between the fundamental and its SHG we have established the optimal conditions to achieve maximal photoinduced changes of absorption, birefringence and third harmonic generation (THG). We have detected changes of the birefringence and of the THG immediately after the laser treatment. We study an influence of the nanoparticle's sizes on the observed changes of the optical features. Additionally we have studied the role of different chemical treatment on the structural and optical parameters.