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Photorefractivity and luminescence properties of Sn-doped SiO2 glasses

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Tin-doped silica glass has been recently investigated as photosensitive optical material for optoelectronic device applications. The mechanisms responsible for the material photosensitivity and the optical activity induced by Sn doping are presented. Studies performed on perform slides and on sol-gel bulk samples show that the refractive index change can be ascribed to structural rearrangements induced by photochemical reactions. Photoluminescence measurements indicate that tin atoms are embedded in Sn-substituted Si sites of the silica network. The modified structure shows extremely high stability, and gratings written in fibers exhibit a negligible erasure in 30 minutes below 600 °C. At high UV radiation fluences the refractive index modulation saturates and does not exhibit any decrease. Optical measurements and electron paramagnetic resonance data show that different processes contribute to the refractive index change. The comparison between samples with and without optical absorption at the UV laser wavelength shows that the presence and the consequent laser-induced bleaching of the 5 eV absorption band due to oxygen deficient centres does not appear crucial for photosensitivity. In fact a refractive index change is also observed in samples without detectable absorption at this energy.

Keywords: Photosensitivity, tin, glass, optical fibers, luminescence.