Effects of Thermal Annealing on The Thermoluminescence Properties of Ion-Implanted $SrTiO_3$ B.Tastekin, M.Turemis, M.I.Katı, I.C.Keskin, R.Kibar, A.Çetin and N.Can, Celal Bayar University, Faculty of Arts and Sciences, Physics Department, 45140 Manisa-Turkey, umbra@ymail.com

The wavelength, intensity and temperature dependence of luminescence signals are widely used to provide highly sensitive monitors of imperfections in insulating crystals since variations in local lattice site configurations are reflected by variations of the luminescence. The thermoluminescence is excited by X-ray irradiation of an entire sample. Room temperature ion-implantation into the surface layer changes the TL signals both in terms of their relative intensities and peak temperatures, as well as modifying the emission spectra. Such an intense perturbation of the bulk signals resulting from surface ion beam implantation is extremely unusual. The ion-implantation damage in the surface is thought to act as a trap. There are consequent changes in the thermoluminescence in terms of defect stability and glow peak temperature [1].

In the present work, we present new data from investigations of the TL glow peaks of pure and Cu implanted $SrTiO_3$ (STO). Single crystal of STO has been implanted at room temperature with 200 keV Cu ions 1.10^{16} ions/cm^2 . Thermoluminescence spectra were taken following furnace annealing at different temperatures for 1 h in air. After implantation and after post-irradiation annealing there are changes in the TL glow curves. Figure 1 shows the TL glow curves of pure STO after exposure to X-ray in the dose range from 300 to 1800 Gy. As seen from figure, the glow curve pattern shows TL peaks at 88 ^oC, 141 ^oC, 185 ^oC and 258 ^oC, after annealed at 400 ^oC while it is not observed any TL peaks for unannealed sample.

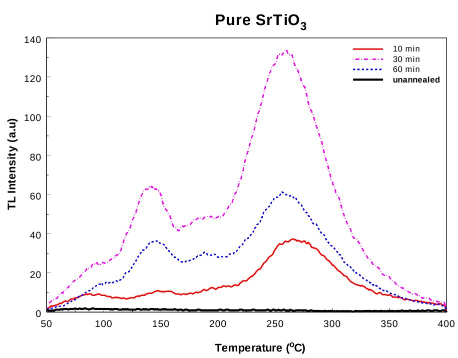

Figure 1. TL response of pure $SrTiO_3$ as a function of X-ray irradiation time after annealed at 400 ^oC.

Figure 2 shows TL response of Cu implanted STO after annealed for different temperatures.

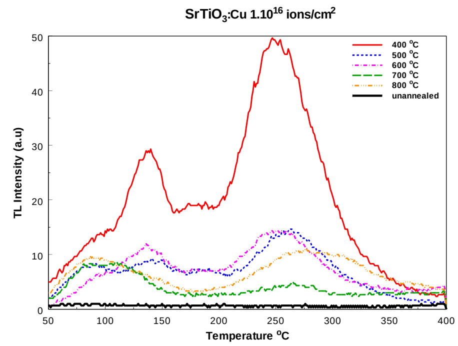

Figure 2. TL glow curves of Cu implanted STO as a function of annealing temperatures. The samples exposed to X-ray for 30 min.

Figure 3 shows the experimental optical absorption spectra of the STO samples implanted with Cu^+ ions to different ion doses. For the sample implanted with copper to a lower dose, the spectrum is similar to that of unimplanted STO, except for a slight increased absorption in the short-wavelength region. Note also that at high implant doses, and strain induced by nanoparticles, implanted layer may no longer be fully crystalline which will increase the band edge absortion. We may conclude that for the lower implant concentration there is no clear indication of the presence of Cu nanoparticles, but the Cu surface plasmon resonance is seen for the higher dose giving a wide absorption band with a maximum near 600 nm, as is typical for copper.

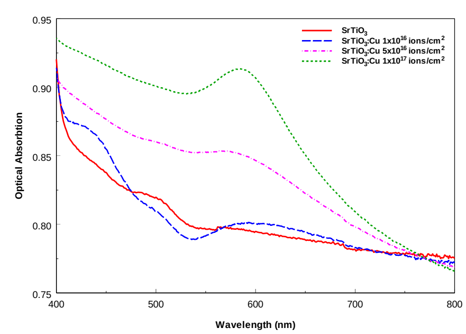

Figure 3. The experimental optical absorption spectra of the $SrTiO_3$ samples implanted with Cu ions to different ion doses.

References: [1] B.Yang et.al. (2004) Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 226 549-555. [2] R. Kibar et.al. (2010) Physica B 405 888–890.