Photoluminescence in disordered $Ba_{0.8}Ca_{0.2}TiO_3$ at room temperature

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Barium calcium titanate of the congruently melting composition $Ba_{0.77}Ca_{0.23}TiO_3$ is an important eletro-optic material for different photorefractive and holographic applications [1]. It has been demonstrated that a series of structurally disordered titanates, synthesized by a soft chemical process, called the polymeric precursor method, have shown intense photoluminescence (PL) effect at room temperature, when excited below your band gap [2].

Ordered and disordered $Ba_{0.8}Ca_{0.2}TiO_3$ (BCT20) powders were synthesized by the Polymeric Precursor Method [3]. The dark-brown powder was crystallized at several temperatures ranging from 400 to 700 °C for 2 hours. The powders were characterized using X-ray diffraction (XRD). The PL spectra were collected with a digital monochromator internally integrated to a CCD. The 355 nm exciting wavelength of a third harmonic of a Nd:YAG Q-switched laser. Titanium K-edge X-ray absorption near edge structure (XANES) spectra were collected at the D04B-XAFS1 beamline at the LNLS-National Laboratory of Synchrotron Light, Campinas, Brazil. LNLS storage ring was operated at 1.36 GeV and around 160 mA.

PL emission observed on BCT20 powders after exciting with laser beam of 350 nm could be associated to a certain degree of order-disorder in the structure of these samples. The BCT20 sample annealed at 500 ^oC presented the high PL emission. XANES experiments pointed out to the coexistence of two types of coordination for titanium which is also associated with PL emission behavior. The amount of TiO_5 decreases as the temperature increases and PL emission decrease.

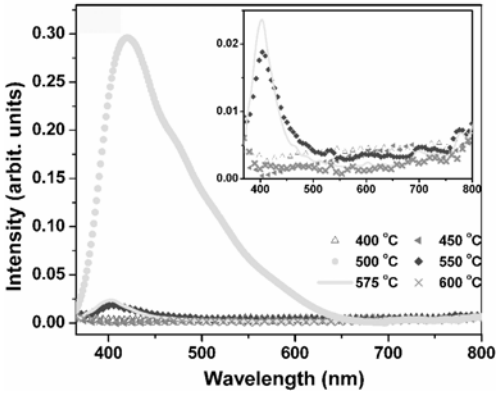

Figure 1 - Room-temperature PL spectra of BCT powder samples annealed at 400, 450, 500, 550, 575 and 600 ^oC for 2 h in an oxygen flow, excitation with 355 nm wavelength.

Keywords: Barium calcium titanate, photoluminescence, disordered titanates, XANES
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[1] C. Kuper, R. Pankrath, H. Hesse, Appl. Phys. A-Mater. Sci. Process. **65,** 301(1997).
[2] P. S. Pizani, H. C. Basso, F. Lanciotti, T. M. Boschi, F. M. Pontes, E. Longo, E. R. Leite, Appl. Phys. Lett. **81**, 253 (2002).
[3] E. Longo, E. Orhan, F. M. Pontes, C. D. Pinheiro, E. R. Leite, J. A. Varela, P. S. Pizani, T. M. Boschi, F. Lanciotti, A. Beltran, J. Andres, Phys. Rev. B **69**, 125115 (2004).
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