¨Optical properties in $Pb(Zr_{1-x}Ti_x)_{1-y}Nb_yO_{3-y/2}$ ferroelectric ceramic system¨

M. D. Durruthy-Rodríguez[1,3], J. Costa-Marrero, M. Hernández-Garcia[1], F. Calderón-Piñar[2], J. M. Yañez-Limón[3], Célia Malfatti[4]

[1] *Departamento de Física Aplicada, Instituto de Cibernética, Matemática y Física, CITMA, La Habana, Cuba.*
[2] *Laboratorio de Magnetismo, Instituto de Ciencia y Tecnología de Materiales, Universidad de La Habana, La Habana, Cuba.*
[3] *CINVESTAV-Unidad Querétaro, IPN, Santiago de Querétaro, Querétaro, México.*
[4] *Departamento de Metalurgia, Escola de Engenharia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS – Brasil.*

Abstract

Ferroelectric materials have been recognized for their unique physical properties and appear to be desirable for optical devices applications. In this work, visible photoluminescence has been observed at room temperature in sintered $Pb(Zr_{1-x}Ti_x)_{1-y}Nb_yO_{3-y/2}$ perovskite-type structure system, doped with Nb using the next excitation lines 267, 325, 373, 457, 635 and 680 nm. The intensity and energy of such emission have been studied by changing the Nb concentration ($0 < y < 0.01$) and the Ti content (x), with x = 0.20, 0.40, 0.53, 0.60 and 0.80, on both sides of the morphotropic phase boundary (MPB) zone. The principal bands become visible at the 1.72, 2.58, 2.92 and 3.41 eV energies. The results revealed the role of the Nb ion substitutions by the Zr or Ti ions and the symmetry presented in the rhombohedra or tetragonal side of the MPB. Raman spectra are similar for compositions 20/80, 40/60 and 53/47 (tetragonal phases), there are four well resolved bands centered around 200, 300, 620, and 750 cm^{-1}. The spectra of the sample 60/40 and 80/20 (rhombrohedral phase) show a significant differences, only show three broad bands, in particular in the region of 200-300 cm^{-1} only show one broad band centered around 250 cm^{-1} where the rest of samples show two well resolved bands. Additionally, optical absorption spectroscopy, structural and micro-structural measurements, performed by the Uv-vis spectroscopy, x-ray diffraction and scanning electronic microscopy techniques, respectively, have been carried out.