Synthesis and characterization of calcium copper titanate (CCTO) doped niobium.

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Abstract

This work we have synthesized calcium copper titanate doped niobium by Pechini method. The samples were characterized morphologically where it was observed that the temperature increase promoted the organization of structure until crystallization of the material. Photoluminescence analysis revealed that the samples doped niobium showed high emition light in the visible region, 475 nm. The analysis of X-ray diffraction confirmed the presence of second phase in all samples.

Introduction

Multifunctional ceramics are of great scientific interest, which should be attributed to the wide variety of applications. The calcium copper titanate (CCTO) is a multifunctional ceramic material that has a structure of perovskite-type ABO_3[1]. The $CaCu_3Ti_4O_{12}$ was doped, replacing the titanium 4+ by an electron donor, niobium. For the synthesis was applied to the polymeric precursor method (Pechini) [2]. The material was calcined at different temperatures aiming to correlate with the properties of the materials obtained with the heat treatments. The CCTO were characterized using thermogravimetric analysis, by scanning electron microscopy (SEM), by photoluminescence (PL) and X-ray diffraction (XRD). The results were correlated with the temperature of the heat treatment.

Results and Discussion

The formation of crystalline phases was observed from 550°C. The powders were calcined at temperatures ranging from 300ºC to 900ºC. XRD analysis proved the existence of a single diffraction pattern of samples.

In the Figure 1 we can observed structures cubic, tetragonals and orthorhombics in the sample containing 5% niobium.

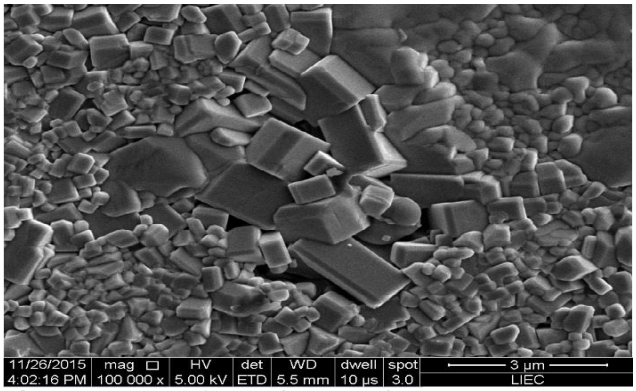

Figure 1. SEM of sample treated at 800 ° C.

In Figure 2 we can observe the influence of doping in photoluminescent behavior CCTO treated at 500 ° C.
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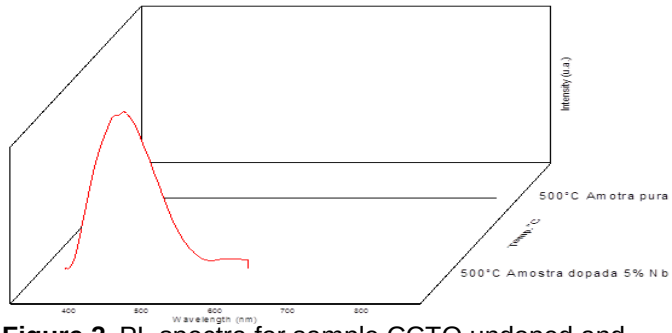

Figure 2. PL spectra for sample CCTO undoped and doped CCTO 5% Niobium.

Conclusions

The crystallization of the ceramic powders was influenced by the increasing calcination temperature. The doping of the CCTO promoted an increase in PL emission around 475 nm in the visible region (blue) for samples doped with 5% niobium..

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2 M. Pechini,. *U.S. Pat. nº* 3 330 697 **(1967).**