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Synthesis and Characterization of $BaZrO_3$ Pr-doped by Pechinni Method

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Abstract – Powders of barium zirconate were synthesized by the polymeric precursor method, with success. The results show that there is a phase transition from amorphous to crystalline phase around 550 °C, this is due to loss of the loss of organic material. There is a larger issue photoluminescence at low temperatures (400 °C). This is due to disorganization of the material that allows more electronic transitions

Barium Zirconate (BZ) is a ceramic oxide that has an high dielectric permittivity, can be used as substrate in the growth of refractory crystals of supercondutores [1]. Others studies also showed that the pure $BaZrO_3$ shows strong photoluminescence blue and green [2].

The barium zirconate was prepared in the form of ceramic powders by the pechinni method (polymeric precursor method): A solution of citric acid was reacted with n-propoxyde zirconium, forming the zirconium citrate which then reacted with barium acetate and ethylene glycol to form a polymeric resin. The doping of the powders was made adding 1 and 2% of Praseodymium on the amount of barium ions before adding the ethylene glycol. Then the resin with different amount of praseodymium has a pre-pyrolysis at 350ºC and after heat treatment at different temperatures up to 800 °C. The structures of the powders were characterized by XRD and the photoluminescents properties of measures of photoluminescence.

In Figures 1 (a and b) shows the XRD patterns for the powders with 1 and 2% of praseodymium doping, treated at different temperatures. In both graphs we can see that the peaks, corresponding to crystalline phase, increases with temperature. This happen because, in fact, the material becomes crystalline with increasing of temperature due to loss of organic matter allowing the reorganization of atoms in crystalline form. The figure also shows that this occurs for the powers with 1 and 2% of praseodymium, which suggests that the dopant ions is suited to the crystalline network very well, maintaining virtually the same structure.

The behavior of the photoluminescence property of the material can be seen in Figure 2 (a and b). This behavior shows that the powder of BZ, in both cases, has the highest photoluminescence emission in the temperature of 400 °C. This fact can be explained considering that the temperature of 400 °C, due to large amount of organic material present, the structure still allows disorderly. This amorphous phase permits to have a large amount of electronic transitions, causing, in turn, large emissions photoluminescents.

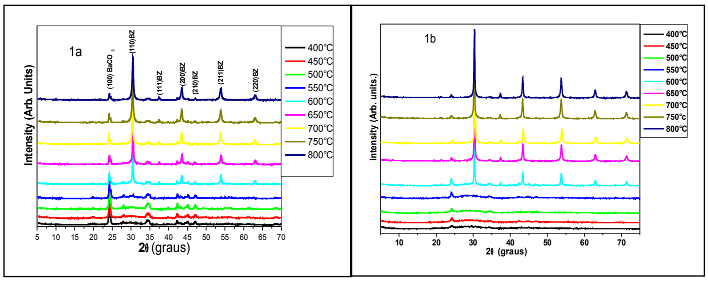

Figure 1: XRD of powders of BZ treated at different temperatures. 1a) BZ doped with 1% of praseodymium. 2a) BZ doped with 2% of praseodymium

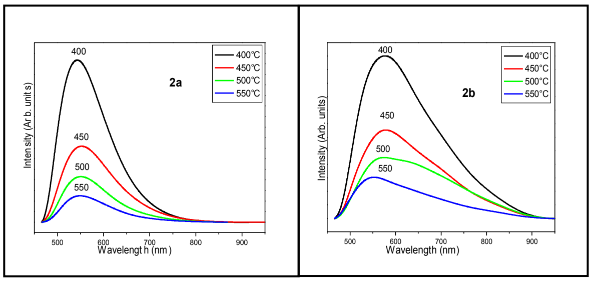

Figure 2: Luminescent behavior of the post of BZ treated at different temperatures. 1a) BZ doped with 1% of praseodymium. 2a) BZ doped with 2% of praseodymium

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