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A Study of the Radioluminescent Properties of ZnO nanopowder Synthesized by Proteic Sol-Gel Process

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Abstract – Zinc Oxide nanopowder have been synthesized by proteic so-gel process, XRD study of these powders indicated a well-defined hexagonal crystal system with Wurtzite structure of ZnO for all the powders calcined above 800 °C. Consequently, for powders calcined below 600 °C there were not typical crystalline phase of ZnO presented, only a mixture of the zinc sulfate and no identified phases. For all the powders calcined above 800 °C, a green light emission was observed when exposed to the X-ray radiation with maximum intensity in 550 nm.

Zinc Oxide (ZnO) has long been used in its powered form in paints and creams to prevent sunburn. The polycrystalline forms have been used for more high-tech uses such as phosphors, piezoelectric transducers, and varistors [1]. In this work, the synthesis of phosphor ZnO nanopowder was carried out via proteic sol gel process. The proteic sol-gel process provides a promising and simples way for production of nanopartilces because does not need complicated equipments and expensive raw materials [2]. However, this method differs from traditional sol-gel process for uses salts as the starting material and coconut water as a chelating agent instead of expensive alkoxides. To prepare the precursor, appropriate amounts of $ZnSO_4 \cdot 7H_2O$ were dissolved in filtered coconut water to form the solutions. Those solutions were put in a greenhouse by 24h at 100ºC for that all the water evaporated remaining the xerogel. Soon afterwards, the xerogels were calcinated at temperatures between 600 and 1400 ºC, during 1h for to eliminate the organic materials and completely oxidize the salts. The calcined samples were crushed in an agate mortar for homogenizing the grains. After that, the powders crystalline phases and structural parameters were identified by X-ray diffraction (XRD) measurements using Cu-α radiation at 40 kV/40 mA on a Bragg-Bretano geometry in the 2θ range of 30º to 70º, in steps of 0.02º, and a counting time of 5 s per step. These values indicated a well-defined hexagonal crystal system with Wurtzite structure of ZnO for all the powders calcined above 800 °C. Consequently, for powders calcined below 600 °C there were not typical crystalline phase of ZnO presented, only a mixture of the zinc sulfate and no identified phases. All the powders calcined above 800 °C presented a green light emission when exposed to the X-ray radiation with maximum intensity in 550 nm (figure 1). This phenomenon is suggestive of the defects induced into ZnO gap when the sulfur was extracted.

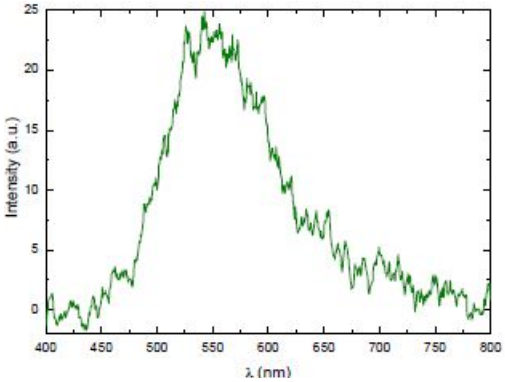

Figure 1: Radioluminescence of the ZnO phosphor powder calcined at 800 °C

References

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