

## Syntheses of nano-ZnO powders by different routes of Pechini method

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**Abstract** : Particle size controlled of ZnO nano powders was achieved through two routes of synthesis, Pechini method (with different relations of citric acid / metal) and modified Pechini method, where the gelatin was used as the reaction guiding. The influence of synthesis method in the materials particle size was observed by X-ray diffraction results and the Rietveld refinement. All the results confirm the high crystallinity and size of crystallites in the nanometer range for the materials synthesized.

The interest in nanomaterials development has been growing in recent years because their physical properties and chemical differences, which promote the achievement of high performance materials for various applications. In nanotechnology field, zinc oxide (ZnO) has been intensively used in several technological applications such as catalysts, varistors, luminescent materials, gas sensors, sunscreen, pharmaceutical materials, among others [1].

Several methods of ZnO synthesis are described in the literature to obtain such materials, among which are the polymeric precursors method (Pechini's method) and the modified polymeric precursor's method (with the use of gelatin). The polymeric precursor's method (Pechini's method) is based on the formation of a polymeric resin produced by the use of hydroxyl carboxylic acids (citric acid) and an poly hydroxyl alcohol such as ethylene glycol. Among the advantages of this method is the possibility of preparing complexes of good homogeneity at the molecular level and stoichiometric control. However, recent studies report the successful of the gelatin use as a polymerization agent in the development of catalyst [2]. This process emerges as a new alternative for obtaining oxides with high efficiency. The advantage of using gelatin is that besides being a chelating agent and polymerizing of metal ions, is a low cost and non-toxic material, making the synthesis easier and faster.

This work aims is the comparative study of zinc oxide obtained by Pechini's method, using two different relations of citric acid / metal cation (2:1 and 6:1), and the modified Pechini's method, in which the gelatin was used as reaction guiding. In all syntheses was obtained nanometric ZnO successfully, under changes in the size of crystallites and their crystallinity, which can be observed by the processing data of X-ray diffraction and Rietveld refinement, according to the routes of summaries used.

Table 1 – Comparison between crystallites sizes (Rietveld and Scherrer), Rietveld refinement parameters.

Sample	Crystallites size by Rietveld (nm)	Crystallites size by Scherrer (nm)	Crystallinity (%)	Rp (%)	Rwp (%)	Rexp (%)	S
ZnO (2:1)	57,10	34,82	85,5631	9,84	14,94	10,36	1,44
ZnO (6:1)	61,14	30,23	77,1492	8,32	11,23	6,36	1,76
ZnO (gelatin)	61,15	25,63	76,6647	7,79	10,88	6,36	1,77

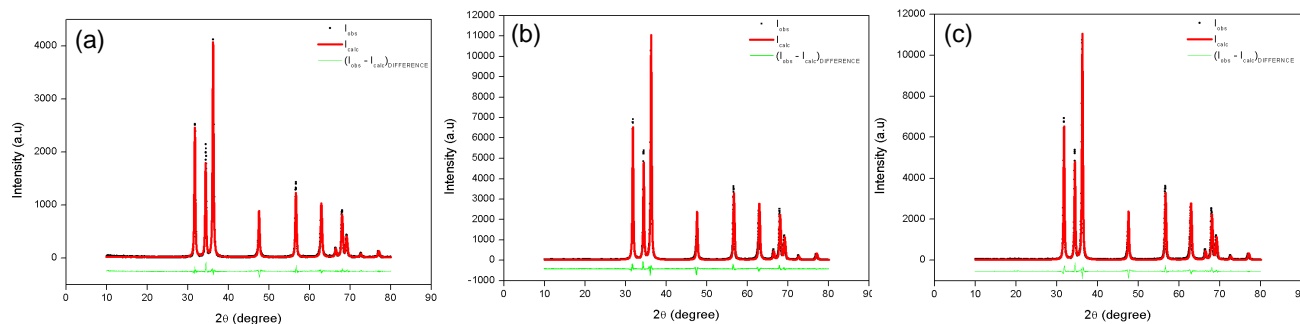


Figure 1 - Rietveld refinement of (a) ZnO (2:1), (b) ZnO (6:1) and (c) ZnO (gelatin)



**11<sup>th</sup> International Conference  
on Advanced Materials**

Rio de Janeiro Brazil  
September 20 - 26

1. Abrarov, S. M.; Yuldashev, Sh. U.; Lee, S. B.; Kang, T. W.; *Journal of Luminescence*, 109, 25–29, 2004.
2. A.O.G. Maia et al.; *Journal of Non-Crystalline Solids* 352, 3729–3733, 2006.