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Synthesis of ZnO Crystals Hexagonal Ball Shape

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Zinc oxide is an important material due to its many applications. It is a wide band gap semiconductor that is piezoelectric and has catalytic activity [1,2]. These properties make it useful in a variety of applications such as solar cells, piezoelectric and chemical sensors [3]. The crystal structure and macroscopic morphology of the ZnO crystals dictates their properties and, thus, the applications for which they can be used. The ability to tailor both the crystal structure and morphology would allow ZnO crystals to be tuned for specific applications. Based on the reaction conditions used in the synthesis of ZnO structures, nanorods, nanowires, nanorings, nanobelts and nanosprings, among others, can be formed [2]. ZnO ball crystal shape was sinthetized using both Sol – Gel method with a hydrothermal soft treatment. In a first step, two solutions were prepared. The first one was obtained by dissolving 5.9498 g of $Zn(NO_3)_2$.6H2O in 21.618 g distilled water. For the second solution, 7.999 g of NaOH was dissolved in 21.618 g distilled water. In a second step, the Na-solution was added slowly (drop by drop) to Zn-solution and stirred at room temperature. The final solution was stirred for 30 min at room temperature to get a material with a molar ratio of Zinc:NaOH:H2O = 1:10:120. The gel obtained was aged in a stainless steel autoclave bottle at 160 °C for 1 day. After the hydrothermal treatment, the sample was washed with 100 ml of distilled water and centrifuged at 12000 rpm during 10 min. After that, the material was dried at room temperature for 1 day. The surface morphology of the samples was analyzed by using a scanning electron microscopy FEG-SEM JEOL JSM 7600. Figure 1 shows an SEM image of several ZnO Crystal hexagonal ball shape showing a diameter about 10 nm and the formation of hexagonal bars with diameters ranged between 1 to 5 µm and length from 3 to 15 µm. Figure 2 shows a zoom of a ZnO crystal hexagonal shape from figure 1 where it is possible to appreciate the form of the ZnO crystal. The results showed that the molar ratio $Zn(NO_3)_2$.6H2O / NaOH and hydrothermal treatment temperature could be critical parameters in the formation of hexagonal ball shape. The high amount of NaOH in the synthesis could increase drastically the pH during the formation of the gel. This effect could be the reason for the formation of several hexagonal bar to form a ball shape. The synthesis procedure presented in this research work is easy with a low cost and can be used to synthetize different kinds of material.

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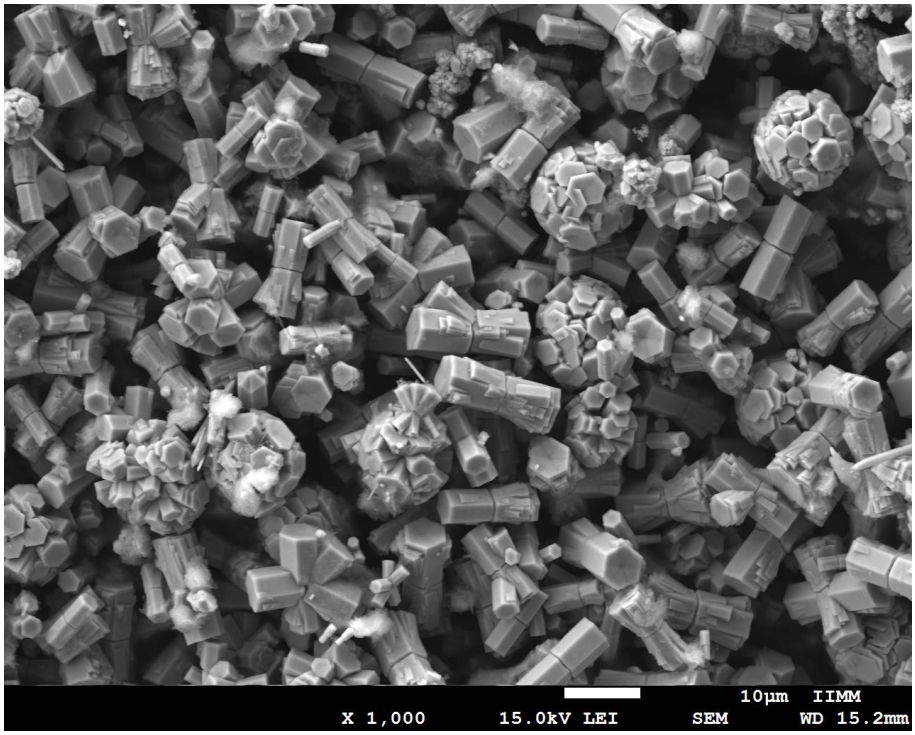

Figure 1. SEM image of ZnO crystals hexagonal balls shape

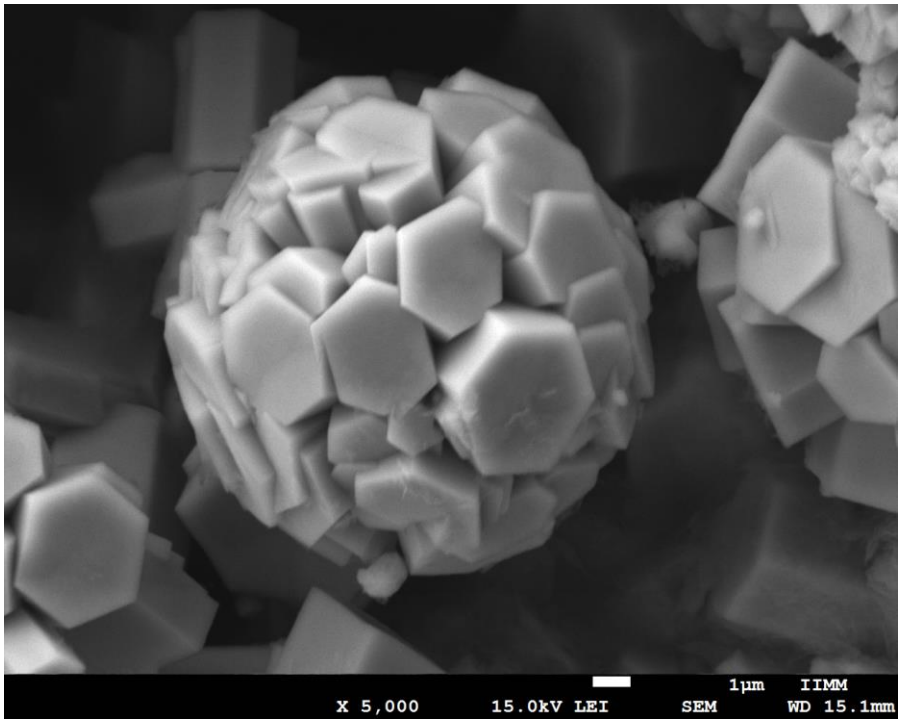

Figure 2. Zoom image of a one ZnO crystal hexagonal ball shape from figure 1.

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