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SEM Study of Zn/ZnO Transition Obtained by Mechanical Milling

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Zinc oxide (ZnO) is an attractive material for many applications in electronics, photonics, sensing, among others [1]. There are a number of techniques for preparing ZnO powders including thermal decomposition, precipitation, spay pyrolysis, hydrothermal synthesis, and mechanochemical processes [2-3]. However, nanocrystalline ZnO is difficult and inconvenient to obtain due to its high degree of agglomeration. Mechanical milling has proved to be an effective and simple technique to produce nanocrystalline powders and the possibility to obtain large quantities of materials. Some studies have shown the effect of high-energy ball milling on the structural and microstructural changes in monoclinic zirconia. [4] The aim of this investigation is to show the transition from the initial laminates of Zn mesh 20 through different milling times into ZnO. The milled powders were analyzed by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The initial materials was Zn mesh 20, the mechanical milling parameters was 500 rpm, 0.5 ml of methanol as a control agent and a weight ratio for ball to powder of 5:1.

In figure 1 we observe the xrd pattern for a Zn simple after 8 h of mechanical milling, where a) reveals the presence of elemental Zinc, this can be attributed to the necessity of a great amount of thermal energy for the formation of the oxide, so it was necessary to keep the process another 8 hours. After 16 hours, as we can see in Figure 1 b), shows the formation of ZnO, this is indicated by one Zn peak. The Figure 2) shows the Zn morphology after 8 h of milling, the image indicates a wide spread distribution of particle size, the range is in the micro scale. Figure 3) represents the formation of ZnO is almost complete, this morphology seems to have more porosity, the distribution of particle size is more disperse and shows discontinuity in some areas.

Mechanical milling allows the Zn/ZnO transition after 16h this was confirm by XRD analysis and SEM images shows the reduction of particle size.

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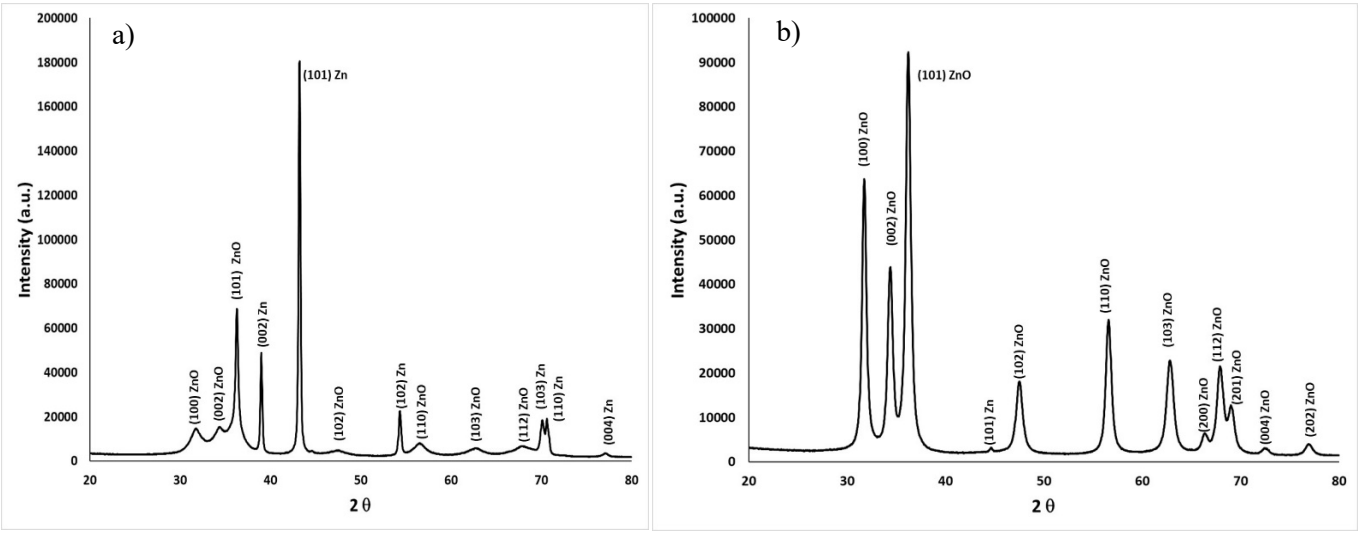

Figure 1. XRD pattern of a) Zn at 8 h of milling and b) ZnO at 16h of milling.

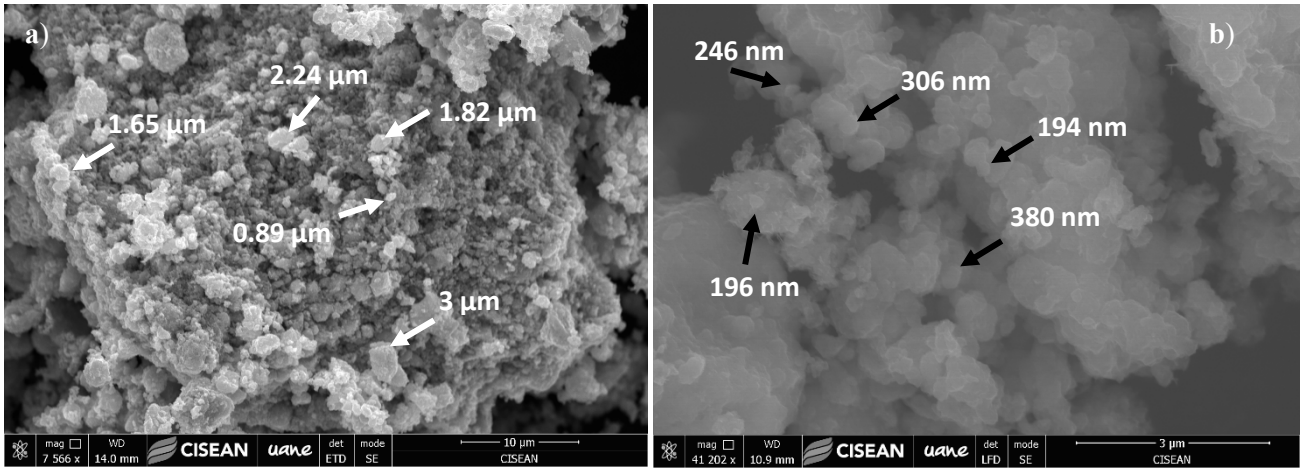

Figure 2. SEM image and for a) Zn after 8h of milling (10 µm, b) Zn after 8 h of milling at 2000x.

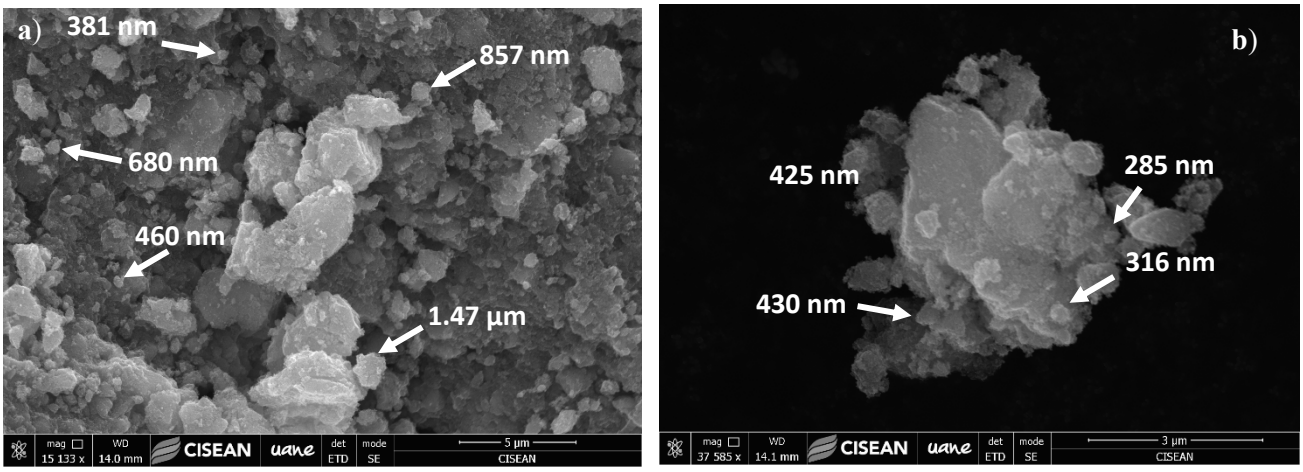

Figure 3. SEM image at different scales for a) ZnO at 16h of milling (5µm) and b) ZnO at 16h (3 µm).

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