Hydrothermal Growth of ZnO over Blow Spun PVA Nanofibers

Eduardo F. Barbosa (PG)[1], Jaqueline A. Coelho (IC)[1], João B. Floriano (PQ)[1], Paula C. Rodrigues (PQ)[1*].

[1]*Departamento Acadêmico de Química e Biologia – UTFPR, Curitiba, Paraná*
eduardoferreirab@hotmail.com; jaque_ac@yahoo.com.br

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Abstract

The PVA/ZnO nanofibers were prepared by blow spinning technique. The nanofibers were characterized by SEM and XRD.

Introduction

Nanostructured ZnO materials have received considerable interest due to their application in optoelectronic devices. The most promising application of the ZnO is as a transparent electrode, due to its wide band gap (3.37 eV) and due to its conductivity can be increased through doping[1,2]. The polyol process permits the synthesis of ZnO nanoparticles with a narrow size distribution, a controlled morphology and high crystalline quality. In this work, a one-pot synthesis was studied to fabricated ZnO nanoparticles. The technique was designed based on polyol hydrolysis process, using zinc acetate and PEG as a polyol solvent. The ZnO was supported in a Poly(vinyl alcohol) matrix (PVA), produced by solution blow spinning technique[3,4].

Results and Discussion

The blow spinning process of PVA nanofibers are illustrated in Figure 1a. The blow spun nanofibers films obtained are flexible and can be easily handled as a free-standing film (Fig. 1b).

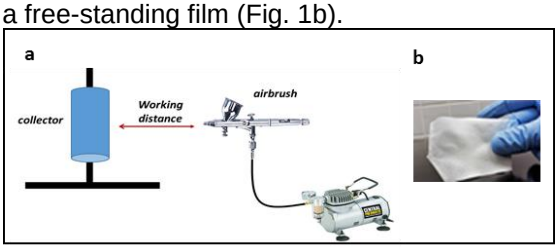

Figure 1 Commercial airbrush setup used for nanofiber deposition (a) and PVA fibers collected on rotating drum (b)

The morphology characterization by Scanning Electron Microscopy (SEM, Figure 2) revealed a PVA fiber network structure, with an average diameter of 500 nm. It was observed that the fiber diameter are influenced by the process parameters like, surface tension and viscosity of the polymer solution, temperature, pressure of the gas source, distance for the collector, etc. The addition of the ZnO-precursor didn´t change the morphology and the diameter of the fibers. After the hydrothermal synthesis, the ZnO was obtained on the PVA nanofiber surface.

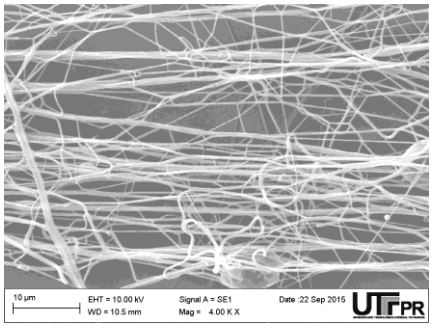

Figure 2. SEM micrograph of blow spinning PVA. P = 2.5 bar; d = 20 cm

The oxide was characterized by X-Ray Diffraction (XRD, Figure 3) and the data suggested the formation of wurtzite structure (JCPDS card no. 36-1451).

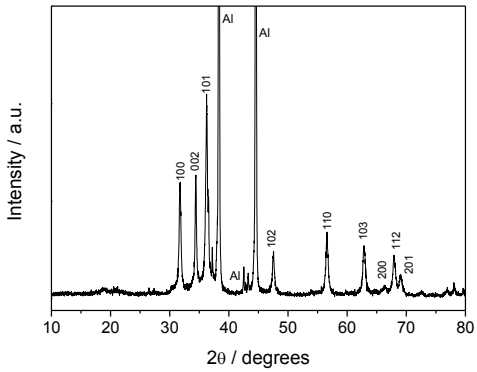

Figure 3.XRD patterns of ZnO particles synthesized using the Polyol process

Conclusion

In conclusion, PVA/ZnO fibers have been successfully prepared using a blow spinning method. The nanofibers are crystalline with a wurtzite structure.

Acknowledgment

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