

Characterization proposal

BERNARDO MORALES

Sample description

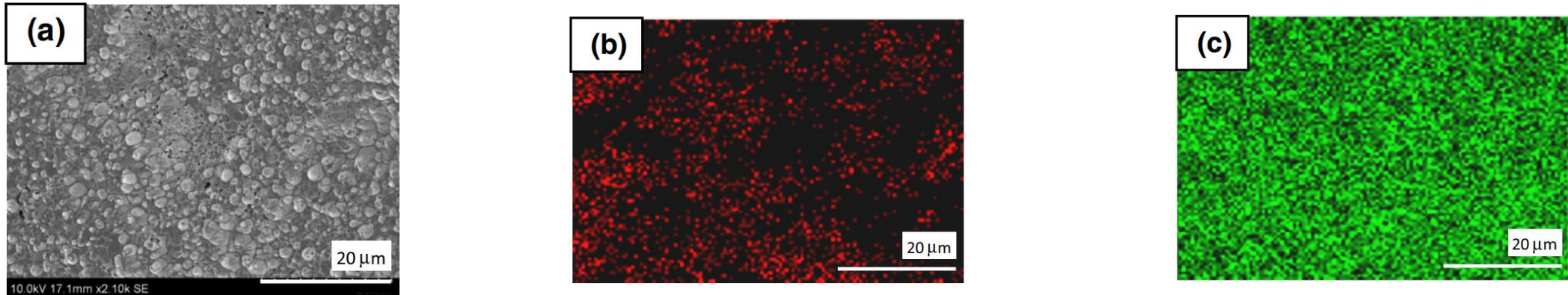
- Zn/ZnO bilayer thin film
- Obtained through reactive magnetron sputtering
- 304L steel substrate, 1 inch diameter, 3 mm thickness
- For application in biosensors

Characteristics to measure

- Chemical composition
- Crystallographic orientation
- Surface smoothness

Surface analysis and chemical composition techniques

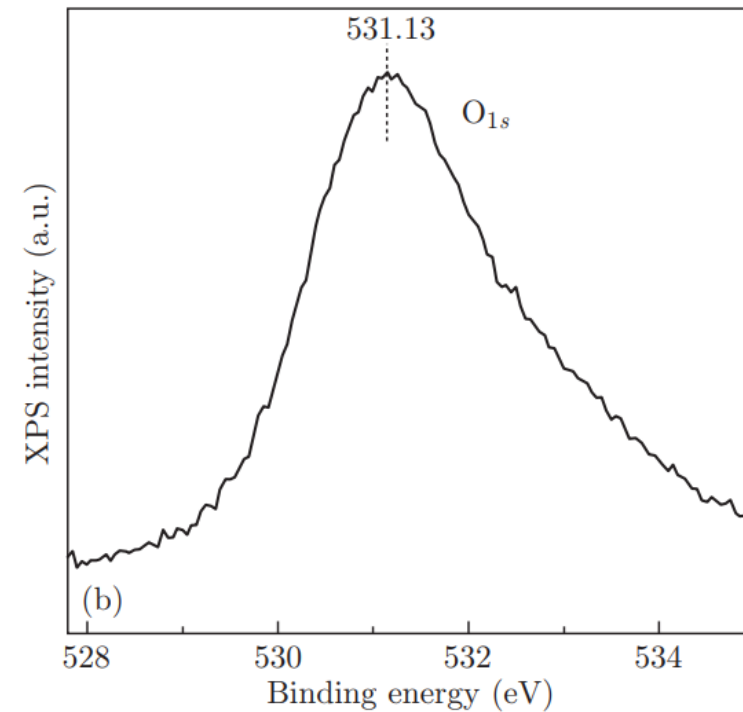
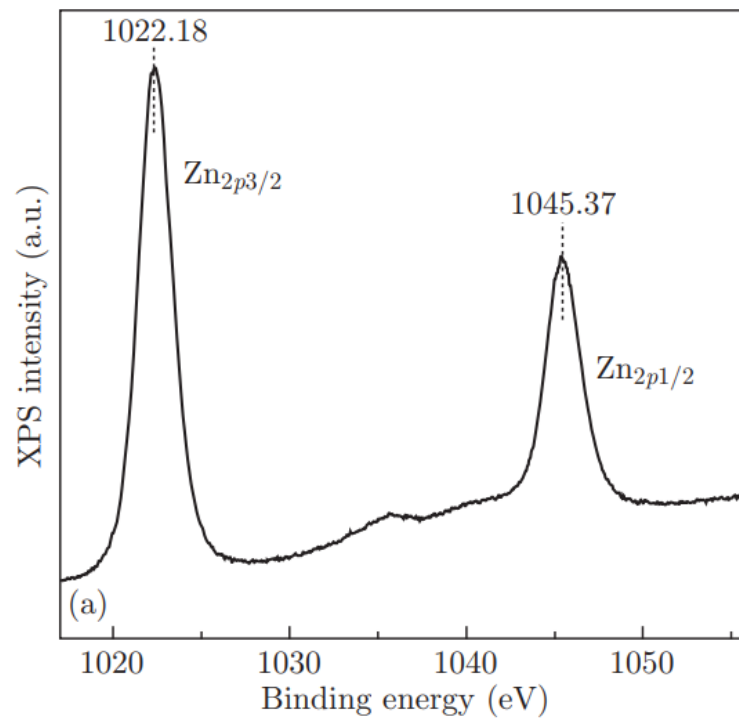
Scanning Electron Microscopy (SEM) and Energy-Dispersive X-Ray Spectroscopy (EDS)



(a) SEM image, (b) EDS mapping of O, and (c) EDS mapping of Zn of a ZnO:Zn composite [1].

Chemical composition

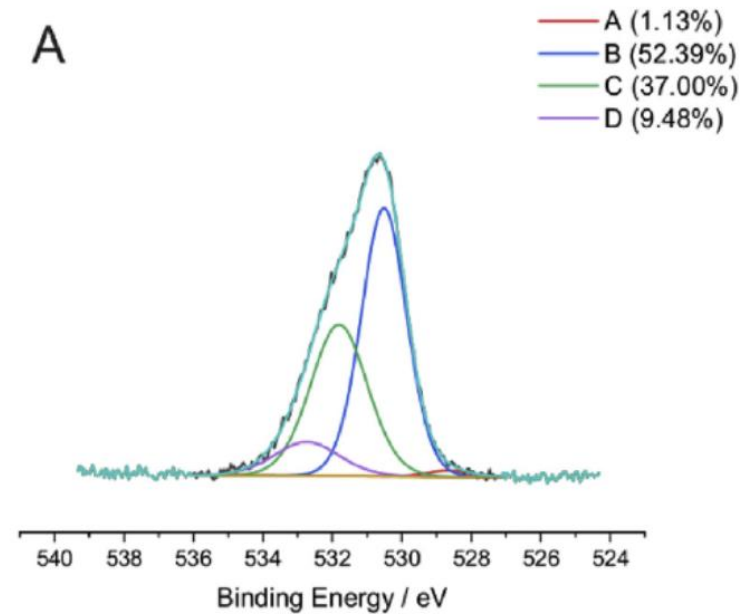
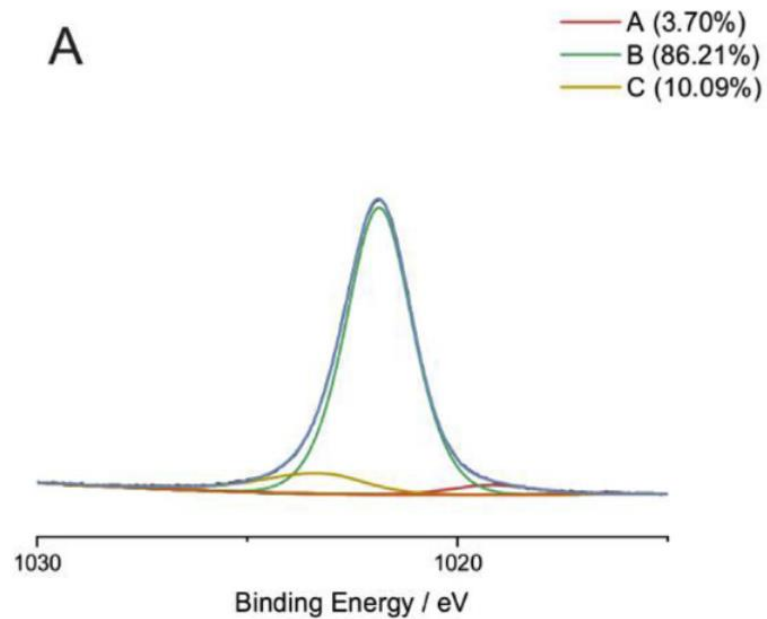
X-Ray Photoelectron Spectroscopy (XPS)



X-ray photoelectron spectrum of (a) Zn2p and (b) O1s for ZnO nanoparticles [2].

Chemical composition

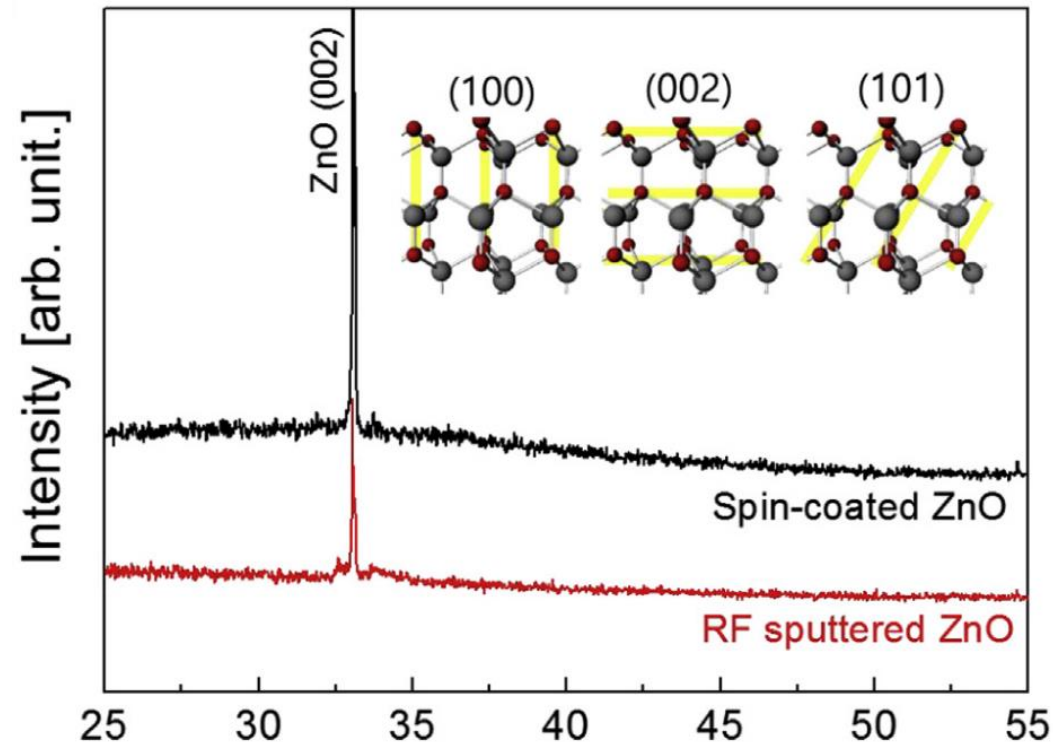
X-Ray Photoelectron Spectroscopy (XPS)



Deconvoluted XPS spectra of Zn (left) and O (right) in a ZnO layer [3].

Crystallographic orientation

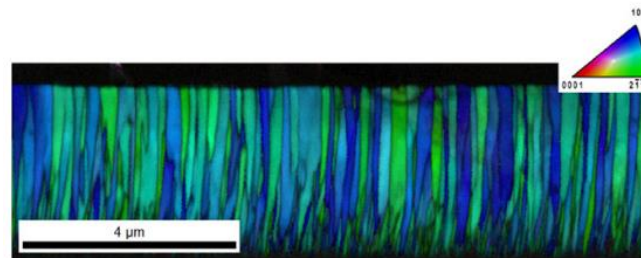
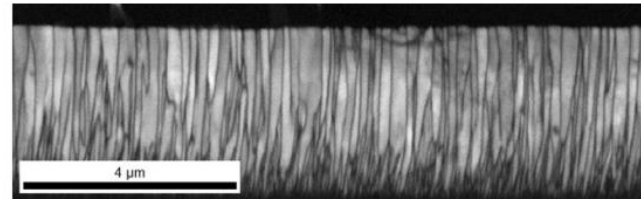
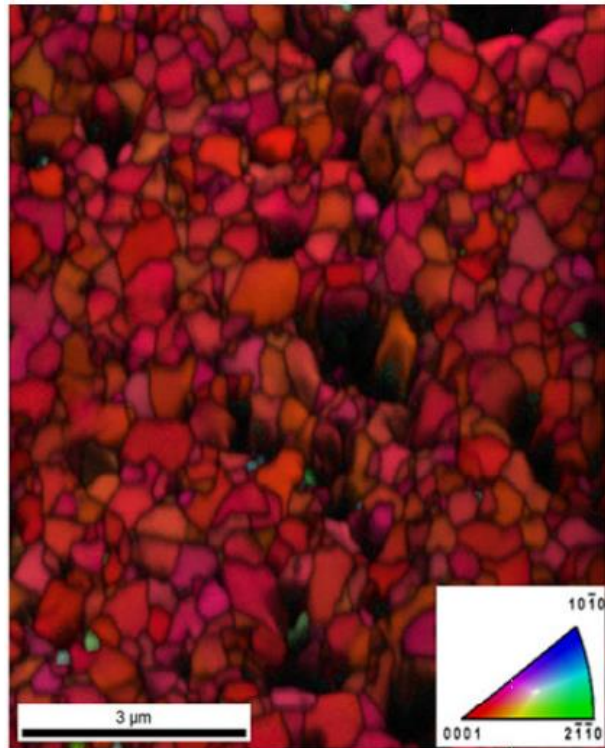
X-Ray Diffraction



XRD plots of spin-coated ZnO NPs and RF sputtered ZnO buffer layers on glass substrates. Inset shows the lattice structure of the preferred orientation of ZnO (Wurtzite structure) [4].

Crystallographic orientation

Electron Backscattering Diffraction (EBSD)



EBSD maps superimposed to a SEM image of a ZnO film(left). Transversal section of a ZnO film (top right), the superimposition of the correspondent EBDS map (middle right) and the superimposition of a 90° rotated EBSD map [5].

References

- [1] L. Q. Zhou, M. Dubey, R. Simões, Q. H. Fan, and V. Neto, “Conductive ZnO:Zn Composites for High-Rate Sputtering Deposition of ZnO Thin Films,” *J. Electron. Mater.*, vol. 44, no. 2, pp. 682–687, 2014.
- [2] K. G. Chandrappa and T. V Venkatesha, “Electrochemical Synthesis and Photocatalytic Property of Zinc Oxide Nanoparticles,” *Nano-Micro Lett.*, vol. 4, no. 1, pp. 14–24, 2014.
- [3] K. Mika *et al.*, “Electrochemical synthesis and characterization of dark nanoporous zinc oxide films,” *Electrochim. Acta*, 2019.
- [4] H. K. Kim, K. B. Chung, and J. Kal, “Comparison of ZnO buffer layers prepared by spin coating or RF magnetron sputtering for application in inverted organic solar cells,” *J. Alloys Compd.*, pp. 487–495, 2019.
- [5] C. B. Garcia, E. Ariza, C. J. Tavares, and P. Villechaise, “Electron backscatter diffraction analysis of ZnO:Al thin films,” *Appl. Surf. Sci.*, vol. 259, pp. 590–595, 2012.