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Synthesis and Characterization of In_2O_3-ZnO Nanostructures via the Precipitation Method

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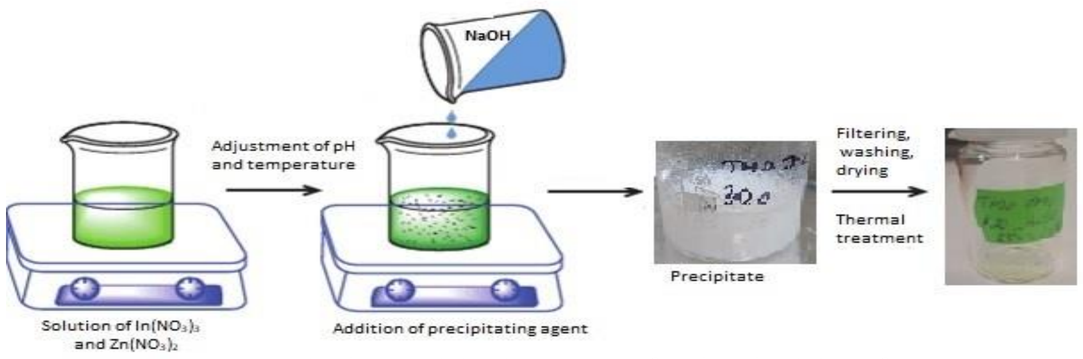
INTRODUCTION & AIM

Nanocomposites, through their synergetic interaction between components, lead to integrated compatible structures, which opens new horizons for their application as materials in the realization of sensors. In_2O_3-ZnO, nanostructures exhibit a large bandgap, high optical transparency, electrical conductivity, uniform surface, chemical and thermal stability in different environments, and excellent photoelectrocatalytic performance, which can be attributed to the enhanced absorption of photons in the visible range and the effective separation of charge carriers at the interface, which makes them interesting for biomedical applications. To obtain these types of materials, the synthesis methods play a fundamental role, influencing the characteristics of the individual components, the bonds formed between them, size, degree of distribution, interface interactions, performance criteria, etc.

In the present paper, for the synthesis of In_2O_3-ZnO composites, the wet chemical method was used, followed by the steps of maturation, aging, filtration, drying, and, finally, heat-treatment steps. To obtain the desired properties of the synthesized composites, it was ensured that the process parameters (reaction temperature, rate of addition of reactants, concentration, etc.) were precisely controlled because they have a direct effect on the size and morphology of the particles.

METHOD



Steps in the precipitation process for the obtaining of In_2O_3-ZnO powder

CONCLUSIONS

❖ *Methods for investigating the structure, morphology, and wetting capacity are consistent with the physical-chemical properties.*

❖The SEM images showed the formation of some spherical particles, with a range of average particle size bellow 50 nm.

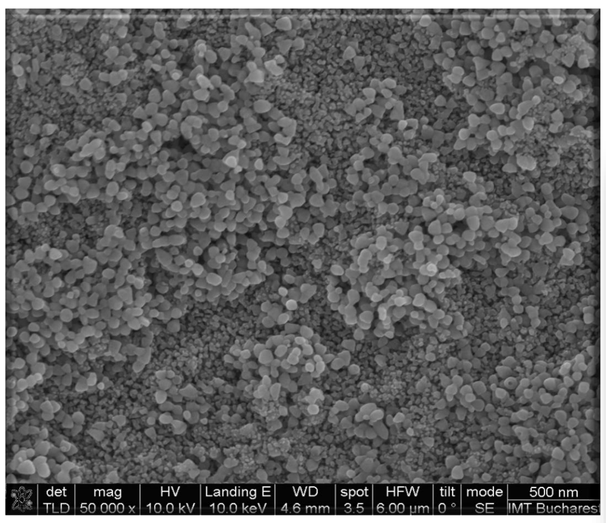
❖ The XRD patterns confirm the hexagonal wurtzite-type crystalline structure (Card No. 00-036-1451) and In_2O_3 (Card No. 00-006-0416). The average crystallite size of the In_2O_3-ZnO NPs was found of 20 nm.

❖ The EDX peaks indicated that zinc, indium and oxygen exist in sample and no other elements were observed in the spectra, which confirms the purity of the nanoparticles.

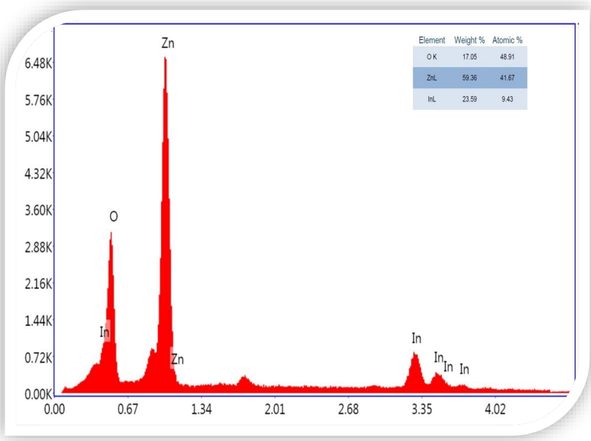
❖ FTIR spectrum reveals the presence of the characteristic In-O and Zn-O bonds, indicating that the precursors used transform to the desired nanostructures.

❖ The wetting capacity exhibits a strong hydrophilic character and good percolation properties, with contact angles varying between 26-12°.

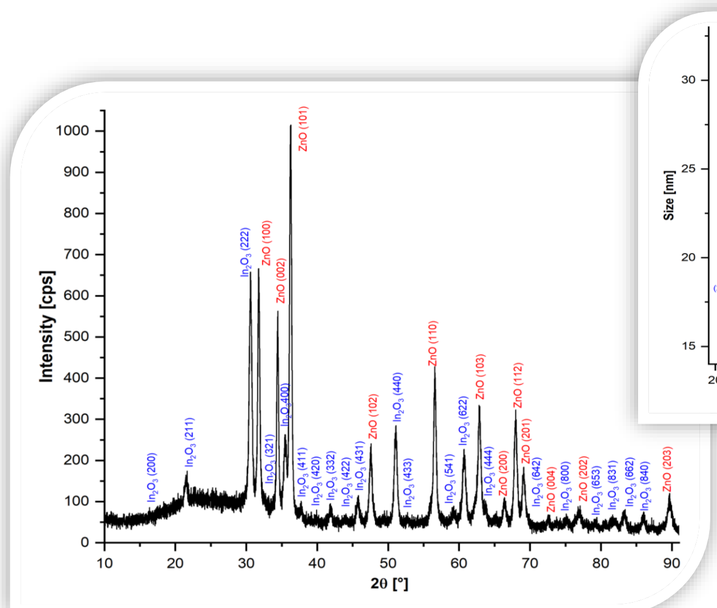
RESULTS & DISCUSSION



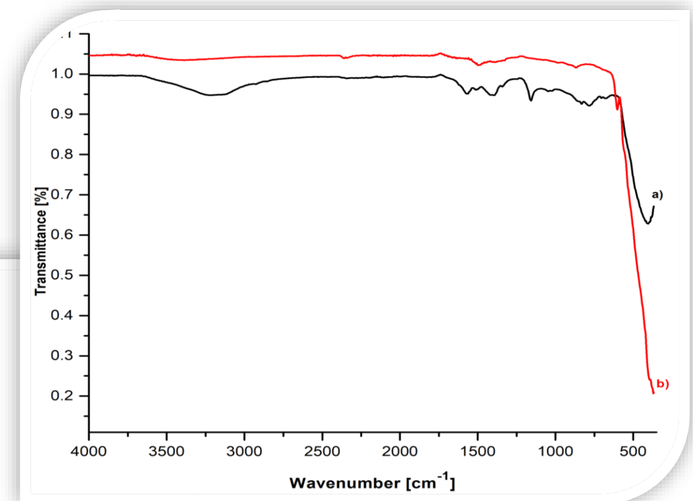
SEM image of In_2O_3-ZnO samples



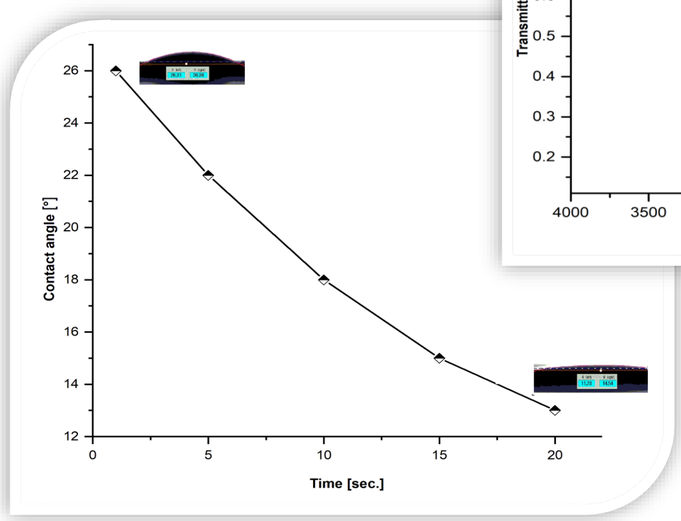
EDX spectra of In_2O_3-ZnO samples



XRD diffraction patterns and size for the In_2O_3-ZnO samples



ATR-FTIR spectra for the In_2O_3-ZnO samples, sintered at a) 100°C and b) 550°C



The variation of contact angle depending on time at the contact of the water droplet with the surface of the In_2O_3-ZnO samples

ACKNOWLEDGEMENTS / REFERENCES

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