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Synthesis and characterization of $ZnO\text{-}TiO_2$ binary nanomaterials for the development of electrochemical sensors

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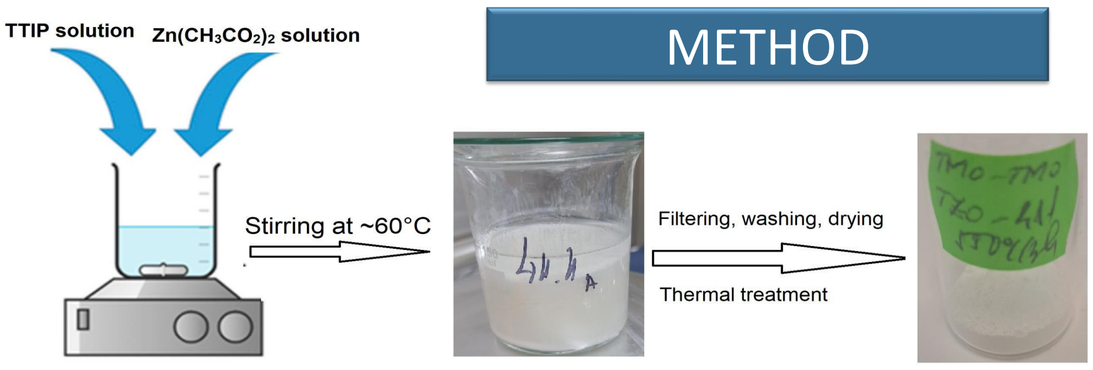
INTRODUCTION & AIM

Hybrid nanomaterials offer new opportunities for performance enhancement and the synergy that arises between the two or more components, making them indispensable in the development of technological devices. By combining TiO_2 with ZnO, materials with promising structures are obtained due to their excellent chemical stability under different conditions, absence of toxicity, and superior photocatalytic activity in the visible light region. The selection of the optimal method influences the performance characteristics of the desired material, depending on the intended purpose.

In the present paper, the $ZnO\text{-}TiO_2$ hybrid materials were obtained using zinc acetate and titanium (IV) isopropoxide as the cation source and a two-step precipitation process. The obtained solution was stirred and maintained at a temperature of ~60°C until the formation of a colloidal precipitate, and centrifugation, decantation, and washing steps were performed the separate the precursor from the supernatant. The prepared nanomaterials were synthesized at 550 °C for 3 h, and their properties were studied in terms of their structure, morphology, and wettability.

METHOD

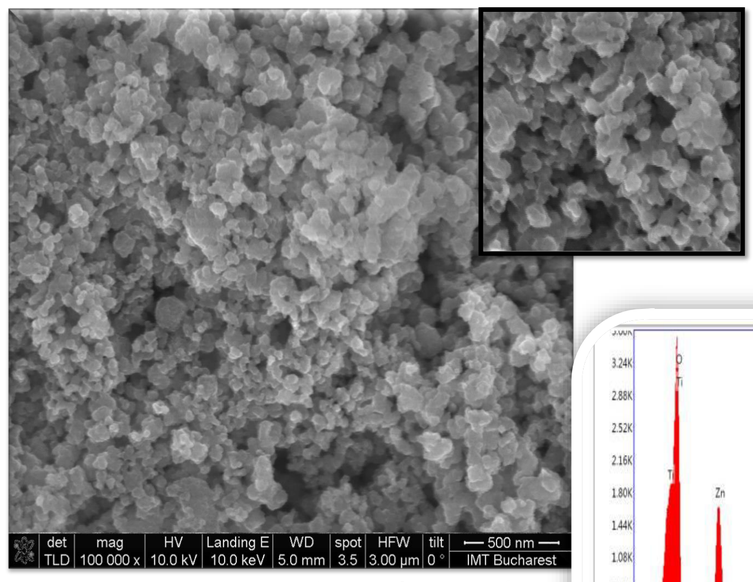


Steps in the precipitation process for the obtaining of $ZnO\text{-}TiO_2$ powder

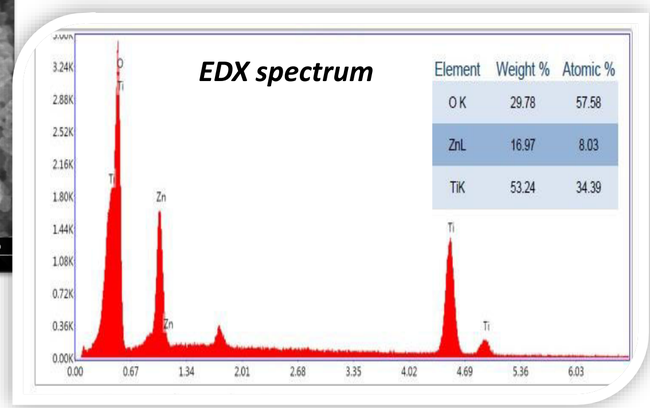
CONCLUSION

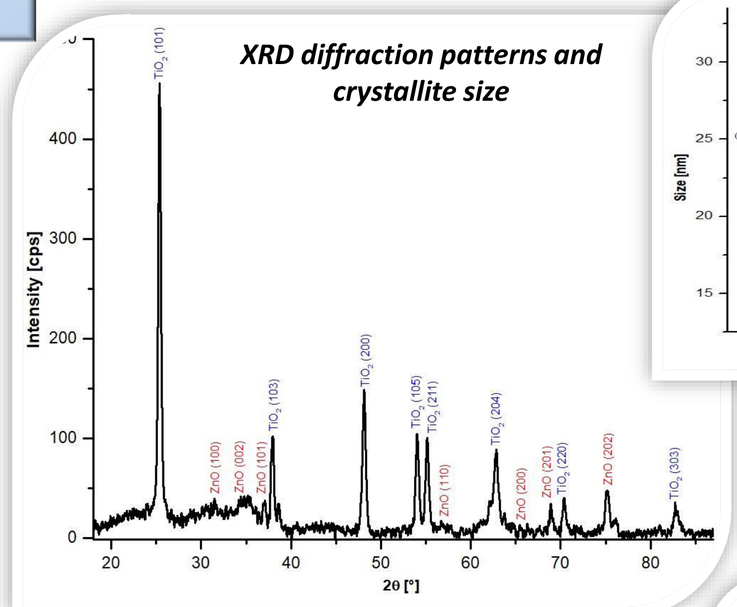
- *Different analytical methods were used to evaluate the physico-chemical characterization of the $ZnO\text{-}TiO_2$ samples.*
- SEM microscopy revealed a porous structure with agglomerated formations, and nanometric particles.
- EDX analysis confirmed the chemical composition and purity of the material at the atomic level.
- FTIR spectroscopy confirmed the existence of M-O bonds in the structure of the hybrid material, due to the appearance in the spectrum of absorption bands that can be associated Zn-O and Ti-O.
- XRD analysis revealed the coexistence of crystalline phases specific to each component, belong to the tetragonal anatase phase TiO_2 (Card No. 00-001-0562) and standard ZnO patterns (Card No. 00-036-1415). The average crystallite size of the sample was ~ 22 nm.
- The materials developed exhibit strong hydrophilicity and the possibility of percolation, demonstrating their potential for the design of a wide variety of sensors.

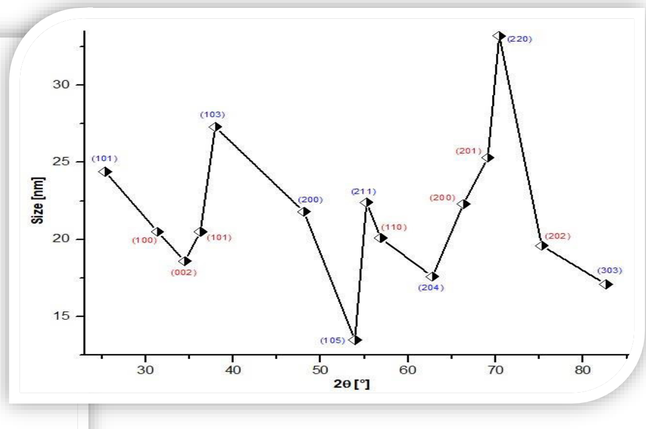
RESULTS & DISCUSSION

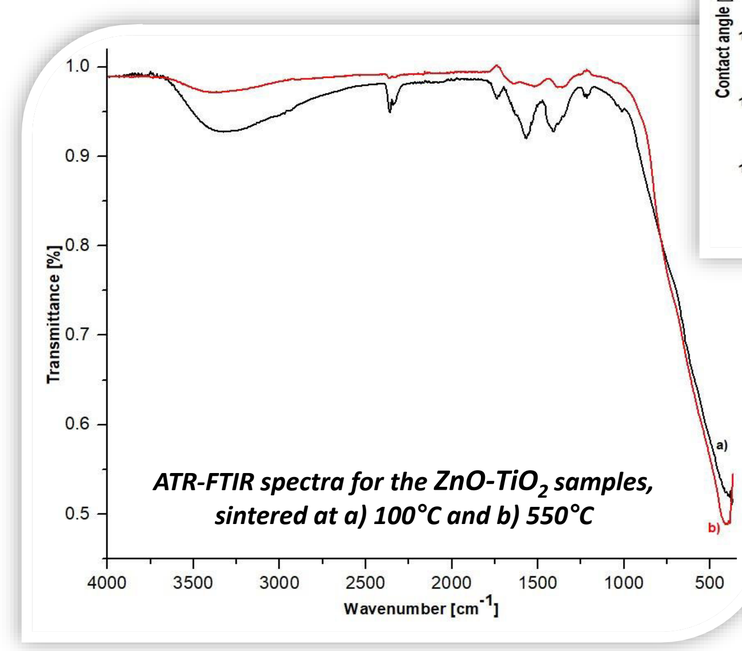


SEM micrograph

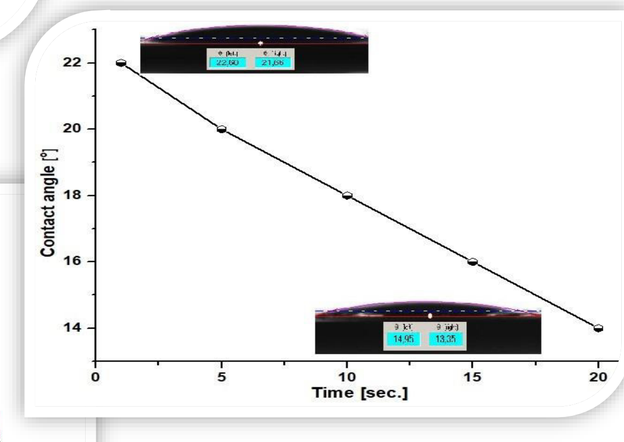








ATR-FTIR spectra for the $ZnO\text{-}TiO_2$ samples, sintered at a) 100°C and b) 550°C



The variation of contact angle depending on time at the contact of the water droplet with the surface

REFERENCES / ACKNOWLEDGMENTS

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