

## Synthesis and Investigation of Pure and Ba-ZnO Thin Films Obtained by Spray Pyrolysis

**Dr. Eng. Pavlina Bancheva-Koleva**

Pavlina Bancheva-Koleva, Veselin Zhelev, Plamen Petkov, Tamara Petkova

Chief Assistantm University of Chemical Technology and Metallurgy, Sofia, Bulgaria

### Abstract

Currently, ZnO is among several semiconductor oxides, such as MoO<sub>3</sub>, SnO<sub>2</sub>, etc. that attract significant scientific interest due to their potential applications in solar cells, high-temperature thermoelectric devices, gas sensors, laser diodes, and more. ZnO also offers advantages such as low deposition temperature, affordability, abundant availability, high exciton binding energy, and non-toxicity. The focus of this study is to examine how barium doping affects the structural, morphological, and optical properties of ZnO.

ZnO thin films, both undoped and doped with barium up to 8 mol%, were prepared on glass and silicon substrates using the spray pyrolysis method. X-ray diffraction (XRD) analysis confirmed that the films exhibit a polycrystalline structure with a hexagonal phase. Profilometry measurements showed that the film thickness ranges from 100 nm to 200 nm. Scanning electron microscopy (SEM) images revealed smooth, uniform surfaces composed of densely packed nanocrystalline grains. Atomic force microscopy (AFM) was used to determine the root mean square (RMS) roughness for undoped and barium-doped ZnO films (0 mol%, 4 mol%, and 8 mol%) respectively. Increasing barium content leads to a reduction in film transmittance, while the optical band gap of the films increases with higher indium incorporation.

### Keywords

Thin films, ZnO, spray pyrolysis.

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