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REVIEWER'S REPORT

Manuscript No.: IJAR-58003

Title: ZINC OXIDE (ZnO) THIN FILMS SYNTHESIZED VIA COMBINED SPIN COATING AND CHEMICAL BATH DEPOSITION METHODS: THE INFLUENCE OF PRECURSOR CONCENTRATION ON THE PHYSICAL PROPERTIES,

Recommendation:
Accept after minor revision

Rating	Excel.	Good	Fair	Poor
Originality			✔	
Techn. Quality		✔		
Clarity		✔		
Significance	✔			

Reviewer's ID: JPR-Bilqees Hamza

Detailed Reviewer's Report

General Overview

The manuscript titled *"Zinc Oxide (ZnO) Thin Films Synthesized via Combined Spin Coating and Chemical Bath Deposition Methods: The Influence of Precursor Concentration on the Physical Properties"* presents a detailed experimental investigation into material science and thin-film technology. The primary objective of the article is to systematically analyze how varying precursor concentration during chemical bath deposition alters the crystalline and optical profiles of resulting zinc oxide structures. To achieve this, the authors implement a rigorous two-step synthesis framework. This approach combines an initial spin-coated seed layer using zinc acetate dihydrate on glass substrates with subsequent chemical bath growth, varying the molar concentration from 0.05 M to 0.30 M prior to controlled thermal annealing. The thin films are then characterized using X-ray diffraction, UV-visible spectroscopy, and photoluminescence spectroscopy.

The research topic holds notable relevance in contemporary solid-state physics, nanotechnology, and optoelectronic engineering. Zinc oxide remains a crucial semi-conducting material owing to its wide direct band gap and large exciton binding energy, rendering it highly useful for solar cells, gas sensors, and light-emitting diodes. A key strength of this work lies in its methodical experimental design and the precise incremental variation of the growth parameters, which provides a transparent view of the

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deposition kinetics. The narrative flow is highly logical, guiding the reader smoothly from chemical preparation and deposition mechanics to structural phase indexing and optical transmission curves.

In terms of contribution, the manuscript adds valuable empirical clarity to the existing literature on low-cost solution-based thin-film synthesis. By demonstrating how a preferred crystallographic orientation along the hexagonal wurtzite lattice plane can be tuned purely via solution concentration, the authors provide reproducible parameters for thin-film optimization. The study is a well-contained, thorough, and highly scholarly piece of work that successfully advances the understanding of cost-effective semiconductor fabrication.

Suggestions for Improvement

While the manuscript is experimentally sound and thoroughly documented, a few minor clarifications and narrative enhancements would further maximize its clarity, presentation, and academic impact prior to final publication.

1. **Elaboration on Substrate Cleaning Protocols:** The methodology section describes the deposition of the seed layer onto microscopic glass slides. To ensure perfect experimental reproducibility, the authors should add one or two sentences specifying the exact pre-deposition substrate cleaning sequence, such as the duration of ultrasonic cleaning in acetone, ethanol, or deionized water.
2. **Clarification of Film Thickness Variations:** The structural results note variations in the peak intensities of the X-ray diffraction patterns. The manuscript would be strengthened by including a brief narrative statement or a qualitative estimation regarding how the film thickness itself evolved as the chemical bath precursor concentration was increased from 0.05 M to 0.30 M, as thickness strongly influences subsequent optical indices.
3. **Refining the Discussion on Dislocation Density:** The authors calculate structural parameters, including crystallite size and dislocation density, across the varying molar concentrations. To improve the narrative flow, the discussion should more explicitly connect these structural alterations to the corresponding changes observed in the optical band gap energy values, highlighting the relationship between lattice strain and electronic transitions.
4. **Detailing Photoluminescence Emission Origins:** The photoluminescence spectroscopy section demonstrates prominent emission peaks, including near-band-edge and deep-level defect emissions. The manuscript would benefit from a slightly deeper interpretation of the deep-level emissions, explicitly discussing whether these are primarily driven by oxygen vacancies or zinc interstitials based on contemporary solid-state theory.

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5. **Standardization of Units in Figure Legends:** The UV-visible transmittance spectra and photoluminescence profiles are cleanly drawn and accurately labeled. To match international publishing standards, the authors should ensure that all axis labels use uniform notation formats across all figures, particularly when denoting wavelengths and photon energy scales.
6. **Minor Typographical and Formatting Adjustments:** The text demonstrates an excellent command of technical language. A minor proofreading pass is recommended simply to verify that chemical formulas, mathematical symbols, and degree Celsius indications remain perfectly standardized in terms of superscripts, subscripts, and spacings throughout the experimental text.

Recommendation

Recommendation: Accept with Minor Revisions

Justification

The manuscript makes a meaningful and highly practical contribution to the field of thin-film materials science by presenting a thorough, step-by-step evaluation of zinc oxide synthesis via accessible chemical methods. The experimental methodology is robust, the characterization techniques are appropriate, and the structural and optical conclusions are directly supported by the empirical data. The identified areas for improvement are minor, focusing entirely on minor methodological clarifications, expansion of defect-mechanism descriptions, and minor formatting consistency. These adjustments can be easily incorporated by the authors and will further polish an already high-quality manuscript, making it fully suitable for publication.