

## Accepted Manuscript

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PII: S0040-6090(17)30672-7  
DOI: doi: [10.1016/j.tsf.2017.09.005](https://doi.org/10.1016/j.tsf.2017.09.005)  
Reference: TSF 36205  
To appear in: *Thin Solid Films*  
Received date: 1 October 2016  
Revised date: 5 September 2017  
Accepted date: 5 September 2017

Please cite this article as: Sana Ullah, Fabio De Matteis, Massimiliano Lucci, Ivan Davoli, Mechanical characterization of stacked thin films: The cases of aluminum zinc oxide and indium zinc oxide grown by solution and combustion synthesis, *Thin Solid Films* (2017), doi: [10.1016/j.tsf.2017.09.005](https://doi.org/10.1016/j.tsf.2017.09.005)

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## Mechanical Characterization of Stacked Thin Films: The Cases of Aluminum Zinc Oxide and Indium Zinc Oxide Grown by Solution and Combustion Synthesis

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**Keywords:** Aluminum zinc oxide, Indium zinc oxide, Solution synthesis; Combustion synthesis, Transparent conducting oxides, Rapid thermal annealing, Nano-indentation, Hardness, Young's Modulus

### Abstract

Mechanical properties of multilayer films of aluminum zinc oxide (AZO) and indium zinc oxide (IZO) prepared from precursors obtained by solution and combustion synthesis have been characterized through nanoindentation. The AZO films have been prepared from solution of zinc acetate dehydrate doped by aluminum chloride, while IZO films have been obtained by mixing indium nitrate hydrate and zinc nitrate hexahydrate in various proportions. The preparation of solutions requires use of 2-methoxyethanol as solvent and of Urea as fuel. Each film of the multilayer stack has been spin-coated, on glass substrate. Films of AZO and of IZO have been heated according to different recipes. X-rays diffraction measurement showed that AZO films were c-axis oriented with hexagonal wurtzite structure, while IZO films showed cubic bixbyite structure. We observe that, for crystalline films, the mechanical behavior follows normal Hall-Petch relation, while in case of amorphous films the hardness came from dopant atoms with higher atomic radii that stresses the lattice due to the size difference.

### 1. Introduction

Non-stoichiometric ZnO due to intrinsic defects of oxygen vacancies and interstitial zinc is an excellent semiconductor material. ZnO has been receiving increasing attention of research community [1] as alternative transparent conducting oxide (TCO) for Indium Tin Oxide (ITO), present industry standard, which occupied more than 90% of the total TCO market as recent as

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