Editorial
Volume 8:3, 2021

Fluid Mechanics: Open Access

ISSN: 2476-2296 **Open Access**

Study of Nanomaterials Prepared by Combustion Method

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Abstract

Nanocrystalline materials like Sn doped In_2O_3 Indium Tin Oxide (ITO) were prepared by this Combustion technique and characterized. Presence of electronic centres in Nanocrystalline ITO is observed from Raman studies and therefore the same has been confirmed by photoluminescence studies. The oxidation properties of ITO were studied by X-ray Diffract meter grain sizes are confirmed by structural studies. As against the expectation of oxide on individual Nano grains of In-Sn alloy, ITO Nano grains grew into faceted Nano grains on heat treatment in air and O_2 atmosphere. The expansion of ITO under O_2 atmosphere showed pentagon symmetry. This Nanocrystalline ITO has been studied using Electron paramagnetic resonance (EPR) measurements. Structural studies by X-ray diffraction (XRD) showed the presence of dominant β phase with a minor quantity of α phase. In EPR, isotopic chemical shift peaks were observed and that they are assigned to originate from the α, β phases of ITO and grain boundary component respectively. From this study, different atomic arrangements were identified in grain boundaries compared to an equivalent within the grain in Nanocrystalline ITO.

Introduction

The atomic arrangement within the grain boundary seems to be somewhat different from regular periodic arrangement whereas inside the grain there's an honest periodic arrangement of atoms. Above 5 mol%, Sn ions form correlated clusters, which cause broadening. These EPR spectra were formed to contain two different components, one from the only isolated ions and therefore the other from the clusters. The recent field of nanoscience and nanotechnology has attracted much interest in research as they fixed many applications. All ITO materials are technologically vital for gas sensors. ITO is employed as a transparent and conducting electrode in solar cells. During this study, preparation and characterization of nanoform of those materials and their important features are going to be discussed. These materials exhibit physical and chemical properties, which are partially or totally different from their coarse grained materials. Technique like XRD, and Electron paramagnetic resonance (EPR) etc. have assisted the expansion of this field. Albeit many materials are prepared by furnace, within the present work, we report the results of a number of the nanocrystalline materials like In_2O_3 doped with SnO_2. ITO particles are analysed by several researchers and an inexpensive understanding has been arrived in transport and optical properties. Metal oxide-based sensors, like tin oxide, indium oxide and indium tin oxide (ITO), are often mixed with many various metallic to reinforce both their sensitivity and selectivity. Gas sensors supported semi conducting oxides present some advantages with reference to other sorts of gas sensors. While several synthesis and processing methods are employed for creating thin-films of ITO research on nano-particles, chemical methods is that the best technique to synthesize ITO powdered nano-particles. Solution combustion method has emerged because the important technique for the synthesis and processing of advanced ceramics catalysts, composites, alloys, intermetallic and nanomaterials. Today Solution combustion method is getting used everywhere the planet to organize oxide materials for a spread of applications. It had been possible to organize oxide material with desired composition. Solution combustion has been directed towards a far better understanding of the role of the fuel urea in controlling the particle size and microstructure of the combustion products.

ITO powders containing relatively high content of Sn were prepared by Combustion starting: with metal salts maintaining: different Sn In ratios 50:50, 70:30, 75:25, 80:20, 85:15, 90:10 and 95:05 EPR studies reflected a possible transformation of hydrated In(III) and Sn(IV) hydroxides to their oxides. It had been found that in ITO, for smaller grain sizes up to 10-20 nm. X-ray diffraction studies showed that the decomposition of In(III)-sn(IV) hydroxides within the mixed system(up to 50% of Sn to five of Sn) prefers the trail of pure In(III) hydroxide ⟶ In_2O_3 whereas above 50% of Sn, the decomposition pattern prefers the trail of sn(IV) hydroxide ⟶ SnO_2.

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Received 02 March 2021; **Accepted** 04 March 2021; **Published** 06 March 2021

How to cite this article: Pizzi Marco. "Study of Nanomaterials Prepared by Combustion Method ." *Fluid Mech Open Acc* 8 (2021): e108.