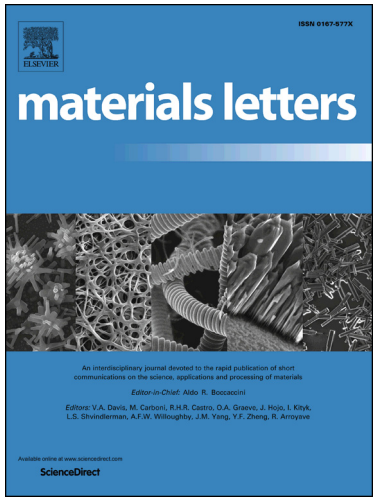

Characterization of InN films prepared using magnetron sputtering at variable power

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Characterization of InN films prepared using magnetron sputtering at variable power

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ABSTRACT

Thin films of indium nitride were deposited on glass substrates using pulsed direct current (DC) magnetron sputtering with various power ranging from 100 W to 150 W. The X-ray diffraction (XRD) patterns of the deposited films revealed polycrystalline peaks of InN having preferred orientation towards the c-plane. The crystal quality of InN was significantly improved with increased sputtering power from 100 W to 130 W. However, with further increase in the power to 150 W, the crystallinity of the film decreased. The morphological results indicated agglomeration of smaller grains into larger ones with increasing power. The band gap and electrical resistivity of InN films decreased with increase of power to 130 W and then started to increase with further increase in the sputtering power. These results were associated with changes in the crystalline quality of InN at different sputtering powers. The optical properties of InN films have also been studied by the first principle approach to support our results about variation in band gap.

Keywords: Thin film**;** Magnetron sputtering**;** Indium nitride; Energy gap**;** Microstructure**;** Computer Simulation.

1. Introduction

The III-V nitrides have been extensively studied due to their highly attractive properties such as wide range of energy band gap (0.7 eV to 6.2 eV), high mechanical strength, and good thermal conductivity. These properties led to the development of blue/ultraviolet (UV) LEDs, absorber layers in solar cells, high-frequency transistors that can operate at high temperatures, and photovoltaic cells [1,2]. The wide band gap range makes these nitrides excellent candidates for absorber layers in solar cells [3]. The absorption edge of these nitrides can be varied to optimize the solar cell efficiency [4]. The electronic devices based on III-V nitrides are also more environmentally friendly as these do not contain toxic elements like arsenic.

Among III-V nitrides, indium nitride (InN) is a promising material for use in optoelectronic devices owing to its narrow band gap. InN films are utilized in highly efficient solar cells and many types of sensors [5]. Importantly, materials with a bandgap between 1.8 eV and 3.1 eV work well in visible light