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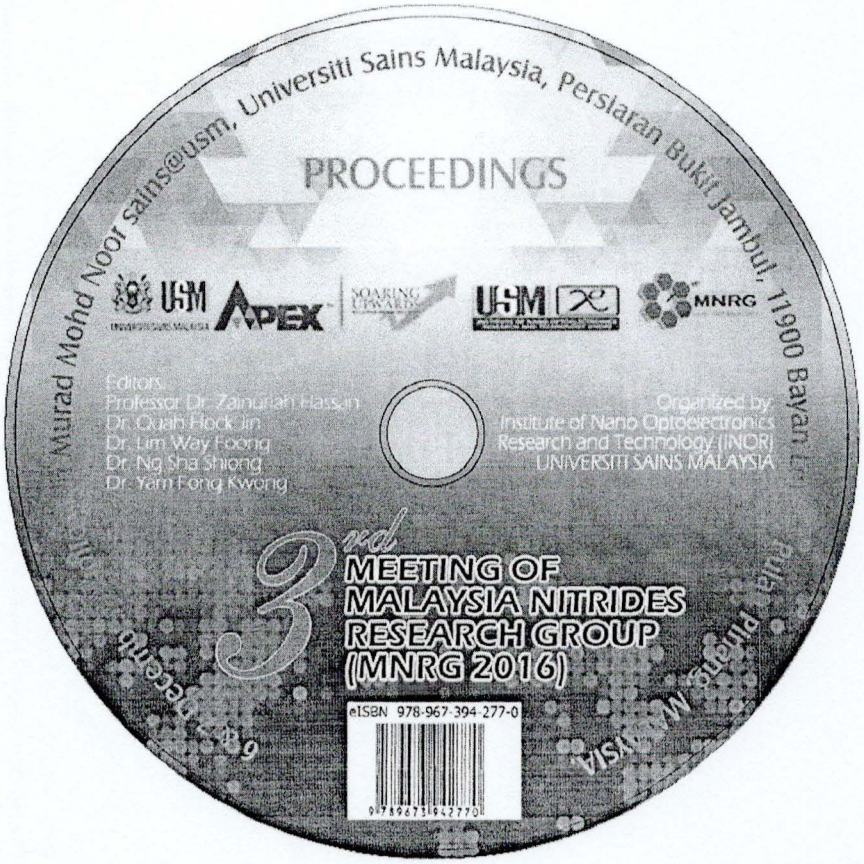
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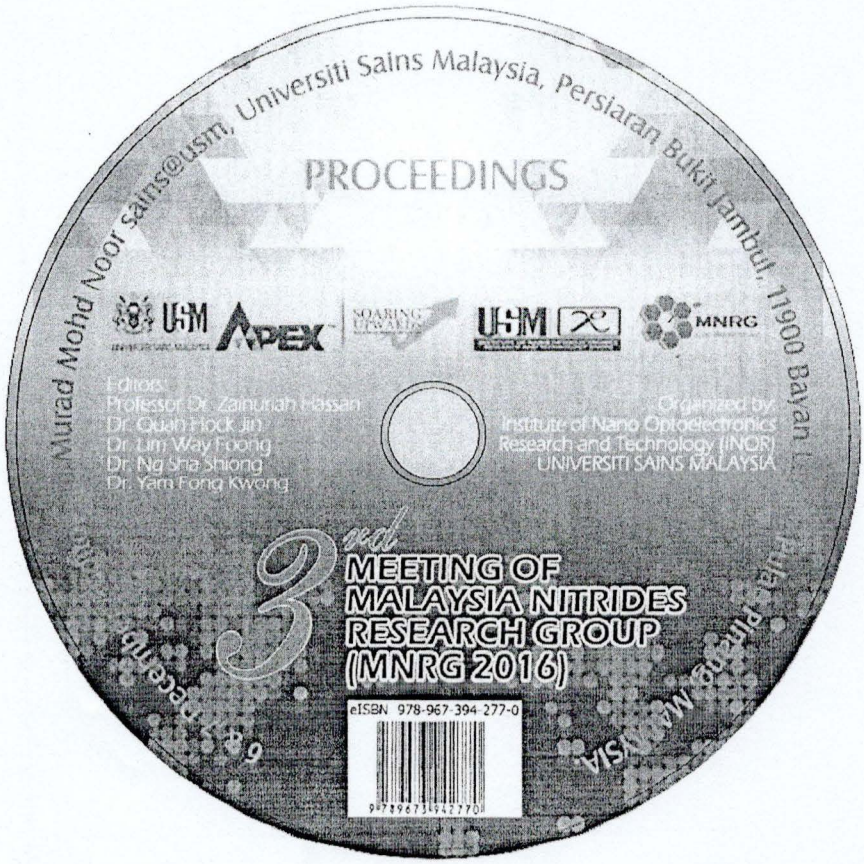
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Influences of Thermal Stability of Doped Indium Nitride Thin Films at Elevated Temperatures by Sol-Gel Spin Coating Method

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ABSTRACT

In this study, doped indium nitride (InN:Mg) thin films grown on silicon (111) substrate are prepared via sol-gel spin coating method followed by nitridation process. The degree of nitridation of In_2O_3 to InN was very sensitive to the nitridation temperature. A custom-made tube furnace was used to do nitridation process which can resolve the low dissociation temperature issue of InN:Mg. In this research, attention was focused on the influences of nitridation temperatures on the structural of the synthesized InN:Mg thin films. The films were nitridated at range 580-620 °C for 45 min and the growth of InN:Mg thin films were investigated. X-ray diffraction (XRD) results revealed that the deposited InN:Mg thin film at 600°C has InN(100), InN(002) and InN(101) preferred orientation. Field emission scanning electron microscopy (FESEM) showed the surface of the films exhibited densely packed grains. Lastly, the elemental composition of the deposited thin films was analysed by using energy dispersive X-rays spectroscopy (EDX). The detected atomic percentages at nitridation temperature 600°C revealed the lowest oxygen percentage with almost 1:1 ratio of indium to nitrogen. Moreover, the atomic percentage of oxygen increases with increasing nitridation temperature. Finally, all the results revealed that 600°C of nitridation temperature was the most efficient temperature for the nitridation process. All the measurements were performed at room temperature.

1 Introduction

The unique properties of group III-nitride compound semiconductors such as indium nitride (InN), aluminium nitride (AlN) and gallium nitride (GaN) and their alloys have inspired many advanced device such as electronics, optics, and magnetic devices [1]. Among the III-nitride semiconductors, InN is particularly interesting due to its high electron mobility, small electron effective mass and low carrier concentration [2]. In the past, there were many of researchers successfully grow high quality InN thin films. However, recent research interests have now been shifted from understanding fundamental properties of intrinsic InN to focusing on the p-type InN using magnesium (Mg), given its success with GaN [3]. However, there are a limited number of studies on p-type InN due to its low dissociation temperature [4] and high equilibrium nitrogen vapor pressure [5].

To date, magnesium doped InN (InN:Mg) has been successful grown using molecular beam epitaxy [6]. However, little works are devoted to the studies of the InN:Mg thin films deposition using sol-gel spin coating method. In view of the attractive features, depth investigation on the sol-gel spin coating growth of InN;Mg thin films is absolutely necessary.

In this work, in-depth investigation on the influences of thermal stability of InN:Mg thin films prepared by sol-gel spin coating technique was carried out. The structural properties of thin films, surface morphologies and elemental analysis of the deposited thin films were characterized by using X-ray diffraction spectroscopy (XRD), field-emission scanning electron microscopy (FESEM) and energy dispersive X-ray spectroscopy (EDX), respectively.