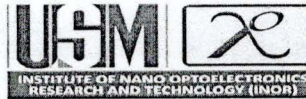




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# PROCEEDINGS

# 3<sup>rd</sup> MEETING OF MALAYSIA NITRIDES RESEARCH GROUP (MNRG 2016)

**6 - 7 December 2016**

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## Effect of Surfactant Concentrations on the Properties of Sol-Gel Spin Coated GaN Thin Films

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**Keywords:** Gallium nitride; surfactant; sol-gel; spin coating; thin films

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### ABSTRACT

We report on the effects of different surfactant concentrations on the properties of gallium nitride (GaN) thin films grown on silicon substrate by sol-gel spin coating method. The precursor solution was prepared using gallium nitrate hydrate powder as starting material, ethanol, diethanolamine (DEA) and distilled water were used as solvent and stabilizer, respectively. Different molar ratios of DEA to gallium nitrate hydrate (i.e., 1:1, 2:1 and 3:1) were used. The crystal structure and orientation of the films were analyzed by X-ray diffraction technique (XRD). The XRD results revealed that all the deposited films with different surfactant concentrations have wurtzite structure and with GaN(002) preferred orientation. Field-emission scanning electron microscopy showed that GaN thin films with uniform and packed grain thin film were formed. Energy dispersive X-ray spectroscopy show that the present of gallium, nitrogen, oxygen and silicon. The optical study was investigated by Fourier transform infrared spectroscopy and the transverse and longitudinal phonon modes of wurtzite GaN were clearly identified from the films prepared under various surfactant concentrations. All the results reveal that the concentration of surfactant plays an important role for quality of GaN thin films.

### 1 Introduction

In recent years, wide and direct band gap energy of gallium nitride (GaN) and its based semiconductors have been extensively investigated due to its potential in optoelectronic and electronic applications, such as bright ultraviolet and visible light emitting diodes, power devices and lasers [1]. This is owing to its superior physical and chemical properties [2]. Traditionally, the GaN thin films were grown by molecular beam epitaxy [3], metalorganic chemical vapor deposition (MOCVD) [4], pulsed laser ablation [5] and sputtering methods [6]. However, these methods have costly and complicated setups. Sol-gel spin coating method is one of the alternative technique that is simple, relatively cheap, and easy method as compared to the mentioned methods [7-9]. Nevertheless, the sol-gel spin coating growth of GaN still have not fully explored. Up until now, the studies that have been reported on this filed were mainly paid to the effects of the nitridation temperature, nitridation duration, and substrate type on the properties of the sol-gel spin coated GaN thin films. According to Fong et al., the wetting of the substrate is one of the main issues in sol-gel spin coating growth of GaN thin films [6]. To overcome it, the surfactant such as diethanolamine (DEA) was proposed. However, the details investigation on this factor have not been carried out.

In this work, we report the effect of surfactant concentrations on the properties of sol-gel spin coated GaN thin films. Different molar ratios of DEA to gallium nitrate hydrate, i.e., 1:1, 2:1 and 3:1 were prepared. Various non-destructive techniques were used to characterize the structural, surface morphology and optical properties of the deposited GaN thin films.