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## Gallium Oxide Nanospheres: Effect of the post-annealing treatment

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### Abstract

Gallium oxide ( $\text{Ga}_2\text{O}_3$ ) nanospheres were successfully synthesized via electron beam evaporation of gallium nitride (GaN) pellets on anodic aluminium oxide (AAO) template. Raman analysis proves the formed nanospheres were  $\text{Ga}_2\text{O}_3$  with all Raman peaks of the  $\text{Ga}_2\text{O}_3$  was present with very good intensities. FESEM analysis proves formation of the  $\text{Ga}_2\text{O}_3$  nanospheres on the surface of the alumina template with diameters of around  $\sim 300\text{nm}$ . Further annealing of the sample eliminates the presence of the nanospheres. Surface roughness analysis via the AFM proved smoother surface was achieved upon higher annealing temperature of 600 and 900°C. In addition, FESEM analysis of the annealed sample at 600°C indicates that the nanospheres were empty hollow spheres rather than full-filled nanospheres.

**Keywords:** Gallium oxide; nanosphere; structural; semiconductors

### 1. Introduction

Varieties of nanostructures composed of various inorganic materials are deemed to have great potential in near future [1]. Amongst such varieties of inorganic material,  $\beta\text{-Ga}_2\text{O}_3$  has been a great deal of interest by researchers in producing its nanostructures. Such nanostructures would include the nanowires [2], nanobelts [1, 3], nanostrips [4], nanoribbons [5] and nanoparticles [6]. Producing the so-called nanostructures is deemed significant as it was reported that with the successful construction of  $\beta\text{-Ga}_2\text{O}_3$  nanowires, a good sensing application was seen achievable [2].

In order to produce the so-called nanostructures, the use of a suitable deposition technique is deemed significant. Reports have shown the use of metal organic chemical vapour deposition (MOCVD) [7], chemical vapour deposition (CVD) [8], thermal evaporation, arc-discharge and sol-gel technique [9] are the most commonly used deposition techniques. Amongst the various deposition techniques used in the growth of  $\beta\text{-Ga}_2\text{O}_3$ , the use of an electron beam

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