LOW TEMPERATURE SOLUTION DEPOSITION OF GALLIUM SULFIDE THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS

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Thin films of Group III sulfides have solicited much interest in recent years due to their potential for use in photovoltaic and optoelectronic devices. For example, gallium sulfide is used in the surface passivation of GaAs and alkaline thiogallate compounds are promising materials for phosphor thin films in electroluminescent displays.[1]

The most common stoichiometries observed for gallium sulfide are the sesquisulfide Ga_2S_3 and the diamagnetic monosulfide GaS, both of which exhibit a variety of structural modifications. The former exhibit 3-coordinate Ga and hexagonal or cubic closed packed structures. The α-Ga_2S_3 (high temperature modification) and β-Ga_2S_3 phases possess h.c.p. unit cells and crystallise in the wurtzite structure, whilst the low temperature modification γ- Ga_2S_3 has the c.c.p. zincblende structure. The monosulfide has a hexagonal layered structure, however, more a cubic modification of GaS has been reported.[2] The direct bandgap of α-Ga_2S_3 is reported as 3.42 eV and GaS as 3.05 eV.[3]

To date, there have been no reports in the literature on the aqueous solution deposition of gallium sulfide thin films. There are fundamental problems towards the solution deposition of gallium sulfides. In general, aqueous solutions of Ga (III) salts are subject to extensive hydrolysis. Moreover, the sulfides are hydrolytically unstable. As part of our general studies on solution deposition of semiconductor materials, we have sought to address some of these issues. In this paper, we outline our approach and report some results of our studies on the chemical bath deposition of gallium sulfide thin films. The films have been characterised by XRD, SEM, EDAX and electronic spectroscopy.

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