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Preparation of Gallium Oxide Thin Films by ALD Using Dimethylgallium Isopropoxide and Water

이희주[1], 우정준[1], 전두진[1], 김윤수[1], 조용재[2], 조현모[2]

[1]고려대학교 신소재화학과, [2]한국표준과학연구원 나노바이오융합연구단

We have prepared gallium oxide (Ga_2O_3) thin films by atomic layer deposition (ALD) on Si(001) substrates using the new liquid precursor dimethylgallium isopropoxide (DMGIP) and water as the oxygen source. DMGIP is a gallium analogue of the aluminum precursor diemthylaluminum isopropoxide (DMAIP) which was successfully used as an aluminum precursor for both chemical vapor deposition (CVD) and ALD. It has a sufficiently high vapor pressure at room temperature (about 3 Torr) and is not pyrophoric at all in contrast to the highly pyrophoric trimethylgallium (TMG). DMGIP was originally developed as an intermediate compound in synthesizing the single precursor $Zn[(\mu\text{-}O^iPr)_2GaMe_2]_2$ for the CVD of $ZnGa_2O_4$. In the deposition of Ga_2O_3 thin films, DMGIP showed an ALD temperature window around 290°C. The film thickness was measured by spectroscopic ellipsometry and the x-ray photoelectron spectroscopic analysis of the films verified stoichiometric formation of gallium oxide. Our results indicate that the DMGIP precursor is suitable for the deposition of Ga_2O_3 films by ALD and further suggest its use as a CVD precursor.