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Growth and characterization of molecular beam epitaxy grown GaN thin films using single source precursor with ammonia

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Gallium Nitride(GaN) attracts great attention due to their wide band gap energy (3.4eV), high thermal stability to the solid state lighting devices like LED, Laser diode ,UV photo detector, spintronic devices, solar cells, sensors etc. Recently, researchers are interested in synthesis of polycrystalline and amorphous GaN which has also attracted towards optoelectronic device applications significantly. One of the alternatives to deposit GaN at low temperature is to use Single Source Molecular Percursor (SSP) which provides preformed Ga-N bonding. Moreover, our group succeeds in hybridization of SSP synthesized GaN with Single wall carbon nanotube which could be applicable in field emitting devices, hybrid LEDs and sensors. In this work, the GaN thin films were deposited on c-axis oriented sapphire substrate by MBE (Molecular Beam Epitaxy) using novel single source precursor of dimethyl gallium azido-tert-butylamine($Me_2Ga(N_3)NH_2C(CH_3)_3$) with additional source of ammonia. The surface morphology, structural and optical properties of GaN thin films were analyzed for the deposition in the temperature range of 600^{o}C to 750^{o}C. Electrical properties of deposited thin films were carried out by four point probe technique and home made Hall effect measurement. The effect of ammonia on the crystallinity, microstructure and optical properties of as-deposited thin films are discussed briefly. The crystalline quality of GaN thin film was improved with substrate temperature as indicated by XRD rocking curve measurement. Photoluminescence measurement shows broad emission around 350nm-650nm which could be related to impurities or defects.