GAN NANOSTRUCTURES FOR USE IN MICROELECTRONICS

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INTRODUCTION.

Group III-N materials such as GaN have interesting properties since they combine direct band gaps ranging from 0.8-6.1 eV with a high breakdown voltage and high electron mobility.

MATERIALS AND METHODS.

Gas-phase synthesis of GaN has been performed using a three-zone quartz reactor (Figure 1). Temperature is a critical parameter for the growth of epitaxial layers, whereas understanding and control of processes leading to bend the structure are highly important. In addition to the temperature profile, the structure is influenced by pressure in the reactor and type of carrier gas; therefore, the temperature profile was investigated by a three-zone furnace.

RESULTS AND DISCUSSION.

We obtained a homogeneous film of gallium nitride with thickness of 2.3 μm and refractive index n = 2.53. The band gap energy of GaN film at 300 K is E_g = 3.39 eV. GaN is deposited in a more or less uniform direction perpendicular to the surface. It appears that structures obtained on a quartz substrate form nanorod arrays of uniform size (1.75 μm) and are directed mainly perpendicular pyramidal to the substrate surface at 4.59 μm height (Fig.2 c, d). The presence of four Raman peaks 252, 418, 566 and 730 cm^{-1} confirms the formation of GaN. Raman spectra peaks E2 (high) = 566 cm^{-1} and A1 (LO) = 730 cm^{-1} correspond elastically strained wurtzite structure of GaN.

CONCLUSIONS.

We have demonstrated possibility of replacing toxic and pyrophoric NH_3, HCl by safer NH_4Cl in the process of GaN synthesis. The method is flexible enough to produce thin films or bulk microrods. Good quality thin films were obtained at relatively low temperatures with high growth rate.

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