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Growth and properties of AlN nanodots: Effects of V/III ratio and substrate bias potential

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Group III nitride semiconductors have attracted considerable attention due to their applications in short-wavelength optoelectronic systems. Aluminium nitride (AlN) has a number of desirable characteristics for photonic applications such as its high direct band gap of 6.2 eV which allows to reach deep UV emission or detection. Studies have shown the possibility to grow nitride nanodots in order to improve the efficiency of nitride based displays. Such studies have not been reported for AlN deposited by Plasma Enhanced Chemical Vapour Deposition (PECVD). In this work, self-assembly of aluminium nitride nanodots on silicon substrate has been studied. We have investigated the dependence of aluminium nitride nanodots growth on (111)Si substrates as a function of input V/III precursor ratio and substrate polarization using PECVD. The different growth regimes are a function of V/III ratio controlled by the nitrogen precursor input in the reactor. Moreover, it is possible to tune the AlN growth to obtain whether a simple thin layer or nanodots on the substrate surface through the bias potential applied to the substrate. This bias potential induces changing in the surface diffusion of adsorbed species and so implies variations in the nanodots dimensions. Atomic force microscopy, Fourier transform infrared spectroscopy and X-ray diffraction have been carried out in order to characterize the surface morphology, the chemical bondings and the microstructural properties of the deposits. These studies complete the understanding of the key processes involved in III-V growth materials.

Keywords
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