GaAs Sub-Micron and Nano Islands by Droplet Epitaxy on Si

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Merging the high efficiency light emitting III-V semiconductors with the state-of-the-art Silicon based electronics is of great interest for the realization of new optoelectronic devices. Unfortunately the heteroepitaxial growth of GaAs thin films on Si is a difficult task because of the difference in the lattice constant, the polar/non-polar surface interaction and the difference in the thermal expansion coeffcients. We present for the first time the MBE growth of GaAs nanostructures on Si substrates by Droplet Epitaxy (DE) [1,2]. We believe this growth method to be promising for the growth of high quality GaAs nanoislands directly on Silicon. In the DE, the substrate is irradiated by a Ga molecular beam flux first, leading to the formation of numerous fine Ga droplets with uniform size, which are subsequently crystallized into GaAs nanostructures by an As molecular beam supply. By changing the Ga droplets deposition temperature is possible to change independently the size and the density of the droplets, while by varying the As flux for the crystallization we can change the final shape of the GaAs nanocrystals. We present the results for the growth of GaAs on Si by DE where the density of the GaAs nanoislands was changed by two orders of magnitude, while the size is varied from around 200 nm to around 20 nm. Measurements by X-ray microanalysis in the TEM confirmed the reaction between Ga and As with formation of GaAs. This has also seen by the presence of Moirè fringes in the TEM images taken in the two beam diffraction mode. The discontinuities Moirè fringes would suggest the presence ofdislocations.