SELECTIVE AREA MOLECULAR BEAM EPITAXY AND STRUCTURAL PROPERTIES OF HIGH QUALITY GaAs/GaNAs CORE-MULTISHELL NANOWIRES

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III–V semiconductor nanowires (NWs) have been gaining particular attention for their application in a variety of optoelectronic devices, including solar cells, photodetectors, and light-emitting devices in a nanoscale. GaNAs is promising material for wavelength tuning within the near-infrared region, where a small fraction of incorporated nitrogen gives rise to a huge downshift of the conduction band edge. We report the growth of GaAs/GaNAs/GaAs core-multishell NWs, which are grown via selective area plasma-assisted molecular beam epitaxy on patterned Si(111) substrates with SiO_2 mask holes. The nucleation and growth of the GaAs NWs' core are carried out by Ga-induced vapor–liquid–solid growth at the open holes. The selective area growth allows the growth of the nanowires at wider growth parameters especially for the growth rate and corresponding V/III ratio. A structurally and optically high quality GaNAs nanowires were obtained at the atomic V/III ratio of 3, showing clear formations of GaNAs/GaAs core-multishell structure in scanning transmission electron microscopy (Fig. 1). Electron diffraction mapping for the NWs reveals the lower twin defect density for the selective area grown nanowires compared to the NWs samples grown on bare Si(111) substrate. The obtained NWs showed lasing up to 250 K, a substantial increase compared with the best previously reported GaNAs NW lasers [1].