III-V NANOWIRES WITH LIGHT-ABSORBING/EMITTING PROPERTIES ON A 2-INCHI Si WAFER

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GaAs nanowires (NWs), III-V compound semiconductors, provide electrical and optical capabilities for mature Si technology. We have obtained large-area growth of GaAs-related NWs on 2-inch Si substrates was by Ga-induced vapor-liquid-solid (VLS) growth using molecular beam epitaxy (MBE).[1] Samples exhibits low reflectivity (<2%) at the GaAs absorption edge and homogeneous emitting properties. We here focused on dilute nitride semiconductors, GaInNAs, whose operating wavelength can be extended to the near-infrared (NIR) region by adjusting the composition of In and N, while suppressing lattice mismatch with GaAs. In this study, we have attempted to fabricate photofunctional materials with optical absorption covering the visible to NIR range and emission properties in the NIR region.

GaAs/GaInNAs/GaAs core-multishell NWs were fabricated on 2-inch n-Si(111) wafer by Ga-induced VLS growth using plasma-assisted MBE and characterised by absorption measurements. The GaInNAs shell layer introduced 20% In and up to 3% N. The reflectance spectra of samples and a Si substrate from the visible to NIR range are shown in Fig. 1. Figure 1 shows that the reflectance of NWs is significantly lower than that of the Si substrate, with GaInNAs samples showing a low reflectance of less than 2% at wavelengths below the absorption edge. The absorption edge in the NIR region can be controlled by adjusting compositions of In and N. In summary, we have fabricated optically functional GaAs/GaInNAs/GaAs core-multishell NWs and operating in the NIR region over a 2-inch Si substrate.