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Surface passivation of III-V compound semiconductors using atomic-layer-deposition grown Al2O3 M.L. HUANG, M. HONG, Y.C. CHANG, C.H. CHANG, Y.J. LEE, P. CHANG, T.B. WU, J. KWO, DEP. OF MAT. SCI. & ENG., TSING HUA U., HSINCHU, TAIWAN TEAM, DEP. OF PHYS., TSING HUA U., HSINCHU, TAIWAN TEAM — Al2O3 was deposited on In0.15Ga0.85As/GaAs using atomic layer deposition (ALD). Without any surface preparation or post thermal treatment, excellent electrical properties of Al2O3/InGaAs/GaAs heterostructures were obtained, in terms of low electrical leakage current density (10-8 to 10-9 A/cm2) and low interfacial density of states (Dit) in the range of 1012 cm-2eV-1. The interfacial reaction and structural properties studied by HRXPS and HRTEM. The depth profile of HRXPS, using synchrotron radiation beam and low energy Ar+ sputtering, exhibited no residual arsenic oxides and elemental arsenic at interface. The removal of the arsenic oxides from Al2O3/InGaAs heterostructures during ALD process ensures the Fermi level unpinning, which was observed in the C-V measurements. The HRTEM shows sharp transition from amorphous oxide to single crystalline semiconductor. The bandgap of ALD grown Al2O3 was measured by O 1s core level loss spectra as 6.55 eV, and valence band offset was 3.78 eV between Al2O3 and In0.15Ga0.85As layers.

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