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Achieving a low interfacial density of states in atomic layer deposited Al_2O_3on $In_{0.53}Ga_{0.47}As$ HAN-CHIN CHIU, L.T. TUNG, Y.H. CHANG, Y.J. LEE, C.C. CHANG, M. HONG, Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan, J. KWO, Department of Physics, National Tsing Hua University, Hsinchu, Taiwan — Atomic-layer-deposited (ALD) Al_2O_3 dielectrics on $In_{0.53}Ga_{0.47}As$ with short air exposure between oxide and semiconductor deposition has been demonstrated nearly ideal capacitance-voltage $(C-V)$ characteristics with negligible frequency dispersion at flat-band and accumulation. A relationship of surface potential versus gate voltage derived by the excellent quasi-static $C-V$ curve shows high efficiency of 63% for Fermi-level movement near the mid-gap. A low mean interfacial density of states ($\overline{D}it$) $\sim$ 2.5x10^{11} cm^{-2}eV^{-1} was determined using the charge pumping method, which was also employed to probe the depth profile of bulk trap density (N_{bt}) and the energy dependence of D_{it} measured at 50kHz: a low N_{bt} $\sim$ 7x10^{19} cm^{-3} and D_{it} of 2-4x10^{11} cm^{-2}eV^{-1} in the lower half of the band-gap and a higher D_{it} of $\sim 10^{12}$ cm^{-2}eV^{-1} in the upper half of the band-gap. The employment of charge pumping method has given a more accurate determination of D_{it}, which is usually overestimated using other commonly methods such as Terman, conductance, and high-low frequencies, due to the influence of weak inversion at room temperature.

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