Energy-band parameters of atomic-layer-deposited Al₂O₃ and HfO₂ on InₓGa₁₋ₓAs M.L. HUANG, Y.C. CHANG, Y.H. CHANG, T.D. LIN, M. HONG, J. KWO, National Tsing Hua University, DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING TEAM, DEPARTMENT OF PHYSICS TEAM — X-ray photoelectron spectroscopy (XPS) combined with reflection electron energy loss spectroscopy (REELS) were used to determine the energy-band parameters, valence-band offsets \( \Delta E_V \), conduction-band offsets \( \Delta E_C \), and energy-band gaps \( E_g \), of the atomic layer deposited (ALD) high k dielectrics of Al₂O₃ and HfO₂ on InₓGa₁₋ₓAs (\( x=0, 0.15, 0.25, \) and \( 0.53 \)). Using REELS, \( E_g \) values of the ALD-Al₂O₃ and -HfO₂ were estimated to be 6.77 and 5.56 ±0.05 eV, respectively. The \( \Delta E_C \)'s and \( \Delta E_V \)'s are larger than 1.5 and 2.5 eV, respectively, for all the ALD-oxide/InₓGa₁₋ₓAs samples. The \( \Delta E_C \) values obtained from the HR-XPS and REELS analyses are in good agreement with those estimated from the electrical measurement according to Fowler-Nordheim tunneling. The results are valuable to the understanding and modeling of the III-V high k MOS devices.

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