In-situ photoemission analyses of ALD-oxide/In\textsubscript{x}Ga\textsubscript{1−x}As (001) interfaces

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J. KWO, Dept. Phys., Natl Tsing Hua Univ., Hsinchu, Taiwan — High-\(\kappa\) dielectrics on high carrier mobility channels, such as In\textsubscript{x}Ga\textsubscript{1−x}As, are now being considered for CMOS technology beyond 15 nm node. The initial bonding of high-\(\kappa\)/InGaAs determines the value and the distribution of interfacial density of states (\(D_{\text{it}}\)) within the In\textsubscript{x}Ga\textsubscript{1−x}As band gap, key to the device performance. In this work, atomic layer deposited (ALD) HfO\textsubscript{2} and Al\textsubscript{2}O\textsubscript{3} on MBE-grown In\textsubscript{x}Ga\textsubscript{1−x}As (001) have been in-situ and ex-situ carried out to investigate the initial stage of interfacial reactions by high resolution photoemission spectroscopy using synchrotron radiation and monochromatic Al Ka x-ray sources. Comparing the results with the corresponding electrical measurements (C-V and G-V at various temperatures), Fermi level unpinning in the oxide/In\textsubscript{x}Ga\textsubscript{1−x}As hetero-structure may be attributed to the exclusion of the As-As and the As-O bonding during the initial interfacial formation.

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