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The mechanism of Fermi level pinning/unpinning at high k Oxide/GaAs interface M.L. HUANG, W.C. LEE, P. CHANG, T.D. LIN, Y.J. LEE, M. HONG, Dep. of Materials Science and Engineering, National Tsing Hua Uni., Hsinchu, Taiwan, J. KWO, Dep. of Physics, National Tsing Hua Uni., Hsinchu, Taiwan — Unpinning of Fermi level at oxide/GaAs interface is the one of the key issues of realizing GaAs-based III-V metal-oxide-semiconductor field-effect-transistors (MOSFETs) for high-speed and high power applications due to inherent advantages of high electron mobility, semi-insulating substrates, and high breakdown fields. In this study several important high dielectric constant materials, Al_2O_3, HfO_2, $Ga_2O_3(Gd_2O_3)$ and Y_2O_3, were *in-situ* deposited on GaAs(001), and exhibited the different Fermi level pinning/unpinning behavior of current-capacitance (C-V) characteristics. In order to correlate the relationship between the oxide/GaAs interfacial structure and their electrical behavior, *in-situ* XPS analysis was conducted shortly after nano high κ oxides were deposited on GaAs. Our studies suggest that Fermi level unpinning in the oxide/GaAs hetero-structure is attributed to the exclusion of the As-As and the As-O bonding during the initial interfacial formation.

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