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***In-situ* XPS, STM and STS analyses of high k oxide/III-V interfaces** MAO-LIN HUANG, Department of Physics, National Tsing Hua University, YU-SHING CHANG, PEN CHANG, HAN-CHIN CHIU, JYUN-YANG SHEN, TSUNG-DA LIN, Department of Materials Science and Engineering, National Tsing Hua University, J. RAYNIEN KWO, Department of Physics, National Tsing Hua University, MINGHWEI HONG, Department of Materials Science and Engineering, National Tsing Hua University, TUN-WEN PI, National Synchrotron Radiation Research Center — The new technology of high-k plus metal gate on high carrier mobility semiconductors like Ge and InGaAs hybrid with Si are urgently pursued for CMOS scaling beyond 15 nm node. The D_{it} distributions of these high k/semiconductor interfaces are generally governed by a peak near the mid-gap, unlike SiO_2/Si showing a flat D_{it} over the entire energy gap. To remove the mid-gap peak in further reducing D_{it}, *in-situ* ALD growth of high k oxides such as Al_2O_3, HfO_2 on various reconstructed $In_xGa_{1-x}As(001)$ surfaces prepared by molecular beam epitaxiy have been conducted to tailor the interface on the atomic level. The mechanisms of interfacial traps at high-k/III-V heterostructures were investigated by using *in-situ* x-ray photoelectron spectroscopy (XPS), scanning tunneling microscopy (STM) and scanning tunneling spectroscopy (STS), particularly in the initial stage of interfacial reactions. The surface species and chemical bonding configurations responsible for unpinned Fermi level are being determined.

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