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Band alignment in $Ge/GeO_x/HfO_2/TiO_2$ heterojunctions as measured by hard x-ray photoelectron spectroscopy ABDUL RUMAIZ, NSLS, Brookhaven National Laboratory, JOSEPH WOICIK, CONAN WEILAND, National Institute of Standards and Technology, Q. XIE, Department of Solid State Science, Ghent University, PETER SIDDONS, NSLS, Brookhaven National Laboratory, CHRISTOPHE DETAVERNIER, Department of Solid State Science, Ghent University — Hafnium based high-k materials have been widely studied to replaced SiO_2 as a gate insulator in field effect transistors. Apart from offering low equivalent oxide thickness, they also offer a favorable band offset with Si. The development in the field of high-k dielectrics has also reduced the significance of Si/SiO_2 interface, thus opening new possibilities with high mobility semiconductors such as Ge. It is well known that the leakage current of a gate stack is dependent on the dielectric constant and the tunnel barrier height. Based on the current scaling trend, an oxide with $k \sim 40$ would be ideal. Among the widely studied oxides TiO_2 is known to have a very high dielectric constant. However the poor conduction band offsets with both Si and Ge, makes it completely impractical as a gate oxide material. The problem of poor conduction band offset has been addressed by introducing a suitable interlayer with higher conduction band offset. In our work we investigate the interlayer thickness dependence of band alignment in a germanium based bilayer metal-oxide-semiconductor sandwich with an amorphous HfO_2 and TiO_2 high k gate dielectric using hard x-ray photoelectron spectroscopy. We see a strong evidence of intermixing at Hf-Ge interface and a deviation from bulk offset for ultra thin HfO_2.

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