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Interfacial engineering and electrical properties of Hf oxide films on InGaAs LYUDMILA GONCHAROVA, OZGUR CELIK, ERIC GARFUNKEL, TORGNY GUSTAFSSON, Rutgers University, NITI GOEL, SAFAK SAYAN, WILMAN TSAI, Intel Corp. — The low chemical stability and poor electrical quality of native oxides, leading to Fermi level pinning, has so far prevented the fabrication of competitive InGaAsbaseddevices, and made integration of InGaAs with high-κ dielectric films a viable option. We have used atomic layer deposition to grow ultra-thin HfO_2 films on InGaAs with several surface passivation and investigated their interfacial and electrical characteristics after Al gate metal deposition using medium energy ion scattering (MEIS), x-ray photoemission (XPS), high-resolution transmission electron microscopy and electrical measurement. Structures with very thin or no interfacial oxide layer were achieved, as measured both by MEIS and XPS. Surprisingly S-passivated samples revealed that the S-containing layer does not stay at the InGaAs/HfO_2 interface but floats on top of the HfO_2 layer during deposition. Interfacial layer formation or Hf diffusion into the substrate was observed after annealing of un-passivated InGaAs devices. Electrical measurements reveal no strong change of capacitance equivalent thickness after the HfO_2 stack is annealed, although a decrease in C-V stretch out as well as in hysteresis for un-passivated capacitors is observed.

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