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Valence Band Alignment at (111) / (0001) ScN/SiC and ScN/GaN Interfaces as Determined by Photoemission SEAN KING, Intel Corporation, ROBERT NEMANICH, Department of Physics, Arizona State University, ROBERT DAVIS, Department of Materials Science and Engineering, Carnegie Mellon University — Scandium nitride (ScN) is a transition metal nitride material that over the past decade has garnered significant interest for nano-electronic, spin-tronic, optoelectronic, electro-acoustic, and thermoelectric applications. This is due to the reasonably close lattice matching exhibited between the (111) plane of ScN (0.3139 nm) and the (111) / (0001) planes of SiC and GaN (0.3073 and 0.3189 nm respectively). For these specific applications, the valence and conduction band alignment of ScN to SiC and GaN will play a significant role. In this regard, we have utilized x-ray photoelectron spectroscopy (XPS) to investigate the growth and interfacial valence band alignment for gas-source molecular beam epitaxy (GSMBE) of ScN on (111) 3C-SiC / (0001) 6H-SiC substrates. Using a detailed analysis of the attenuation of the Si2p core level from multiple ScN growths and XPS measurements, we find that ScN grows on (111) 3C-SiC in a layer by layer fashion. UPS measurements (Figure 1) show the ScN valence band to be 1.6-2.1 eV below the system Fermi level indicating a minimum band gap on this order. Detailed XPS/UPS measurements indicate the ScN/3C-SiC valence band offset is small ($\leq$ 0.3 eV). Additional measurements for GSMBE GaN on ScN show a larger interfacial valence band discontinuity of $\sim$ 0.8 eV.

Sean King
Intel Corporation

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