Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

**Band Alignment of Plasma-Enhanced ALD High-k Dielectrics on Gallium Nitride** JIALING YANG, BRIANNA ELLER, CHIYU ZHU, ROBERT NEMANICH, Arizona State University — GaN-based transistors have shown immense promise because of their high saturation velocity and breakdown field, but their performance is limited by the high gate leakage. This limitation is mitigated with the use of metal/high-$k$ oxide/III-N structures. This experiment investigates three promising high-$k$ dielectrics deposited by plasma enhanced ALD: $Al_2O_3$, $HfO_2$, and $La_2O_3$. The band gaps of these materials are 6.5eV, 5.8eV, and 4.3eV, while the dielectric constants are 9, 20, and 27, respectively. The large band gap associated with $Al_2O_3$ reduces the leakage current; however, the lower dielectric constant increases the equivalent oxide thickness. The band alignment of the high-$k$ oxide/GaN interface plays a critical role in determining the confinement properties of semiconductor carriers and ultimately device performance. In situ photoemission gave valence band offsets for $Al_2O_3$, $HfO_2$, and $La_2O_3$ with GaN as 1.8eV, 1.3eV, and 0.9eV. The results are described by the charge neutrality level and interface dipole models. We also investigated the use of $Al_2O_3$ as an interfacial passivation layer between $HfO_2$ and GaN.
This research is supported by the Office of Naval Research.

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Date submitted: 11 Nov 2011 Electronic form version 1.4