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Influence of Pre and Post-treatments on Plasma Enhanced ALD SiO2 and Al2O3 layers on GaN MEI HAO, Arizona State University — GaN-based transistors are projected to be the next generation power electronics due to its excellent material properties. In this research, electronic properties of the resulting interfacial oxide layer on GaN-based metaloxidesemiconductor (MOS) devices were investigated using plasma enhanced atomic layer deposition (PEALD) dielectric layers. The goal was to reduce the leakage current through the dielectric layer. Dielectric layers of SiO2 and Al2O3 have a band gap of 9 eV and 6.5 eV respectively. It has been an expected breakdown field 10 MV/cm for Al2O3 on GaN. However, PEALD dielectric layers are very sensitive to the GaN surface before deposition. Different pre-treatments of GaN before the PEALD process can create different surface conditions, which influence the dielectric layer structure and electronic properties. In this study, the band alignment of SiO2 and Al2O3 on GaN was examined with an x-ray photo-electron spectroscopy. An N2/H2 plasma pre-treatment at 680? was employed prior to SiO2 and Al2O3 deposition, and a breakdown field of 9.9 MV/cm was found for SiO2 and 7 MV/cm for Al2O3. Moreover, a post-deposition annealing of the Al2O3 on GaN samples with different temperatures, influenced the electrical behavior, including removal of interface charges.

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