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Nucleation and stochiometry dependence of rutile-TiO_2 thin films grown by plasma-assisted molecular beam epitaxy COSTEL CONSTANTIN, Seton Hall University, KAI SUN, University of Michigan, R.M. FEENSTRA, Carnegie Mellon University — Considerable interest has been shown of late in transition-metal oxides. One case is the titanium dioxide system, which can have applications as a high-k dielectric gate insulator for Si-based devices[1]. In this study, rutile-TiO_2 thin films were grown on GaN(0001) substrates by oxygen plasma-assisted molecular beam epitaxy. Two sets of films were grown, one in which the initial GaN surface is prepared WITH the pseudo 1×1 Ga-rich surface reconstruction, and the other set, WITHOUT the pseudo 1×1. On top of these two type of surfaces, the rutile-TiO_2 thin films were grown at $T_s \sim 600\ ^oC$, and with a thickness $\sim$ 40 - 50 nm. During growth, reflection high-energy electron diffraction indicated a reversible stoichiometry transition from O-rich to Ti-rich growth. Post-growth x-ray diffraction measurements performed on the samples WITHOUT the GaN pseudo 1×1, show the presence of additional peaks at $2\theta = 52.9^o$, which implies the existence of additional phases. In addition, the high-resolution transmission electron microscopy performed on these samples show a high degree of disorder, as compared to the samples prepared WITH the pseudo 1×1. Work supported by ONR.

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