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Interfacial reaction between metal-insulator transition material NbO_2 thin film and wide band gap semiconductor GaN AGHAM POSADAS, University of Texas at Austin, ALEXANDER KVIT, University of Wisconsin - Madison, ALEXANDER DEMKOV, University of Texas at Austin — Materials that undergo a metal-insulator transition (MIT) are potentially useful for a wide variety of applications including electronic and opto-electronic switches, memristors, sensors, and coatings. In most such materials, the MIT is driven by temperature. In one such material, NbO_2, the MIT mechanism is primarily of the Peierls-type, in which the dimerization of the Nb atoms without electron correlation causes the transition from metallic to semiconducting. We describe our initial work at combining NbO_2 and GaN in epitaxial form, which could be potentially useful in resistive switching devices operating at very high temperatures. We grow NbO2 films on GaN(0001)/Si(111) substrates using reactive molecular beam epitaxy from a metal evaporation source and molecular oxygen. X-ray diffraction shows that the films are found to grow with a single out of plane orientation but with three symmetry-related orientation domains in the plane. In situ x-ray photoelectron spectroscopy confirms that the phase pure NbO_2 is formed but that a chemical reaction occurs between the GaN and NbO_2 during the growth forming a polycrystalline interfacial layer. We perform STEM-EELS analysis of the film and the interface to further elucidate their chemical and structural properties.

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