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Epitaxial growth of in-plane-dimerized, single phase NbO_2 thin films for metal-insulator transition applications AGHAM POSADAS, TOBIAS HADAMEK, ANDY O'HARA, ALEXANDER DEMKOV, University of Texas at Austin — NbO_2 is a exhibits a metal-insulator transition that may have potential applications in electronic devices. The strong conductivity change in NbO_2 occurs along the dimerization direction and for devices utilizing NbO_2 as a channel material (in-plane transport) such as transistors, one would like the dimerization direction to be in the plane of the film. The electrical properties of Nb oxides are strongly dependent on the oxidation state of Nb. It is therefore critical to be able to control the oxidation state of Nb during growth. Here, we describe the epitaxial growth of in-plane-dimerized NbO_2 using molecular beam epitaxy on a variety of substrates (STO, LSAT, MgO, BTO and GaN), growth temperatures, and oxygen-to-niobium flux ratios. We show that the particular substrate used significantly affects the bulk and surface crystallinity, as well as the degree of oxidation. We also show the evolution of the valence and core level photoemission spectra of Nb oxides as a function of oxygen-to-niobium flux ratio and point out the optimum growth conditions to achieve phase-pure, epitaxial NbO_2 films.

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