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Controlling the electronic properties of Er_2O_3 thin film by oxygen vacancies AARON WANG, ANDREW YOST, VIVEK JAIN, QILIN DAI, JINKE TANG, TEYU CHIEN, University of Wyoming — With a high dielectric constant and wide bandgap, Er_2O_3 is suitable for applications in electronic and optical devices. It is known that in many oxide materials, oxygen vacancy concentration plays a decisive role in engineering the properties of the oxides. To address the oxygen vacancy concentration effects on the properties of Er_2O_3, here we present Scanning Tunneling Microscopy and Spectroscopy (STM/S) and X-Ray Diffraction (XRD) studies of the Er_2O_3 thin film made by Pulsed Laser Deposition (PLD). XRD shows Er_2O_3 thin film deposited at 700°C in high vacuum (HV) (sample 1) has broader peaks compared to that of the one deposited at room temperature (RT) in HV followed by 400°C annealing in air (sample 2). This indicates that, for sample 1, the loss of long range periodicity in crystal structure is mainly due to oxygen vacancies. Moreover, a relatively rough surface with 2 to 5 nm nanoclusters were observed in sample 1 by STM; while sample 2 is too resistive for STM measurements. In addition, Scanning Tunneling Spectroscopy (STS) analysis for sample 1 revealed the bandgap as well as features in the conduction band which may be related to the oxygen vacancies.

Aaron Wang
Univ of Wyoming

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