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Atomic Resolution Study of the Interfacial Bonding at $Si_3N_4/CeO_{2-\delta}$ Grain Boundaries[1] ROBERT F. KLIE, WERONIKA WALKOSZ, SERDAR OGUT, University of Illinois at Chicago, A. BORISEVICH, PAUL F. BECHER, STEVE J. PENNYCOOK, JUAN C. IDROBO, Materials Science and Technology Division, Oak Ridge National Laboratory — Using a combination of atomic resolution Z-contrast imaging and electron energy-loss spectroscopy (EELS) in the scanning transmission electron microscope, we examine the atomic and electronic structures at the interface between Si_3N_4 $(10\bar{1}0)$ and $CeO_{2-\delta}$ intergranular film (IGF). Ce atoms are observed to segregate to the interface in a two-layer periodic arrangement, which is significantly different compared to the structure observed in a previous study. Our EELS experiments show that **(i)** oxygen is present at the interface in direct contact with the terminating Si_3N_4 open-ring structures, **(ii)** the Ce valence state changes from +3 to +4 in going from the interface into the IGF, and **(iii)** while the N concentration decreases away from the Si_3N_4 grains into the IGF, the Si concentration remains uniform across the whole width of the IGF. Possible reasons for these observed structural and electronic variations at the interface and their implications for future studies on Si_3N_4/rare-earth oxide interfaces are briefly discussed.

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Serdar Ogut
University of Illinois at Chicago

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