

Hydrogen Induced Metallicity on the ZnO(10 $\bar{1}$ 0) Surface

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(Received 24 August 2005; published 27 December 2005)

Exposure of the mixed-terminated ZnO(10 $\bar{1}$ 0) surface to atomic hydrogen at room temperature is found to lead to drastic changes of the electrical properties. The insulator surface is found to become metallic. By employing several experimental techniques (electron energy loss spectroscopy, He-atom scattering, and scanning tunneling microscopy) together with *ab initio* electronic structure calculations we demonstrate that a low-temperature (1 \times 1) phase with two H atoms in the unit cell transforms upon heating to another (1 \times 1) phase with only one H atom per unit cell. The odd number of electrons added to the surface per unit cell gives rise to partially filled surface states and thus a metallization of the surface.