How a hydrogen passivated surface could appear to be metallic: the story of the 3C-SiC (001) 3x2 surface
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Tunnelling Microscope
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Photocurrent band electrons at a polar surface can explain the experimental results. The surface is, in fact, completely passivated by hydrogen (no partially filled states near the conduction band edge of the silicon rich non-polar GaN surfaces only little is known about the exact positions of the surface states and thus their possible influence on the Fermi energy. Therefore, we investigated GaN(110) cleavage surfaces by cross-sectional scanning tunneling microscopy and spectroscopy [1]. We identified the energy positions and types of surface states as well as the origin of the Fermi level pinning on GaN(110) cleavage surfaces. It is found that both the N and Ga derived intrinsic dangling bond surface states are outside of the fundamental band gap. The observed Fermi level pinning 1.0 eV below the conduction band edge is attributed to the high step and defect density at the surface but not to intrinsic surface states. [1] L. Ivanova et al., APL 93, 192110 (2008). This work is supported by the DFG.

Initial stages of GaN(0001)-2x2 - oxidation
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We studied the initial oxidation stages of 2x2 reconstructed Ga-face GaN(0001) grown in-situ by PAMBE. The oxidation process was characterized using X-ray and ultraviolet photoelectron spectroscopy (XPS, UPS), as well as reflection high energy electron diffraction (RHEED). In particular, the evolution of the valence band structure, the work function and the core levels of gallium and nitrogen as well as the increase of the oxygen O 1s emission were studied in combination with the corresponding RHEED pattern as a function of oxygen exposure. The clean GaN(0001)-2x2 surface exhibits two surface states at 2 eV (S1) and 3.5 eV (S2) below the Fermi level. The exposure to O2 results in two well pronounced valence band structures at binding energies of about 6 eV and 11 eV, respectively, which are caused by the adsorbed oxygen. The 2x2 reconstruction as well as the S1 state disappear rapidly, revealing an extremely high reactivity of the as grown GaN surface, whereas the S2 state vanishes considerably slower.