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# Surface electron accumulation layers in oxide semiconductors[1]

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In contrast to the electron depletion at the surface of almost all n-type semiconductors, electron accumulation has long been known to be observable at ZnO surfaces. It has recently been found to be a characteric of several other oxide semiconductors, including CdO [1,2], $In_2O_3$ [3] and $SnO_2$. They all have a significant size and electronegativity mismatch between their cation and anion. As a result, they have a particularly low $\Gamma$-point conduction band minimum which is ultimately responsible for the propensity for electron accumulation. In addition to the mere existence of an electron-rich surface layer, it has been found, using angle-resolved photoemission spectroscopy (ARPES), to be quantized into two dimensional subbands [1]. Moreover, the conventional one-electron picture of surface space-charge in semiconductors is shown to be inconsistent with the electronic structure that we observe directly from ARPES, indicating that many-body interactions play a large role in the surface electronic properties of these semiconductors. Such interactions lead to a depth-dependent shrinkage of the semiconductor band gap, resulting in a surface band gap which differs from the bulk value [1]. The most recent studies have focussed on the influence of depositing alkali metals onto the surface of these semiconductors. Many collaborators are acknowledged for samples and ARPES expertise.

[1] P. D. C. King, T. D. Veal et al., Phys. Rev. Lett. 104, 256803 (2010)
[2] P. D. C. King, T. D. Veal et al., Phys. Rev. B 79, 035203 (2009)
[3] P. D. C. King, T. D. Veal et al., Phys. Rev. Lett. 101, 116808 (2008)

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