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Increased binding energy of impurities near a semiconductor vacuum interface. PAUL KOENRAAD, INEKE WIJNHEIJMER, JENS GARLEFF, Eindhoven University of Technology, KARIN TEICHMANN, MARTIN WENDEROTH, SEBASTIAN LOTH, R. ULBRICH, University of Gottingen — We have recently shown that a STM tip can be used as a tool to manipulate the charge state of a single impurity below the cleavage surface of a semiconductor. This manipulation allowed us to determine the binding energy of single donors and acceptors as a function of their depth (up to 1 nm) below the surface. We found that the binding energy strongly increases near the surface. In the case of a Si-donor in GaAs the binding energy increases continuously from 5.6 meV in the bulk to more than 100 meV close to the surface. Our STM techniques also allowed for the determination of the size and shape of the Coulomb field of single ionized donors. We found that the range of the potential is strongly reduced relative to the bulk value. Both the reduced range of the Coulomb potential and the increased binding energy can be related to a reduced dielectric constant and increased effective mass near the surface. We will discuss the implications of these findings.

Paul Koenraad
Eindhoven University of Technology

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