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Combined conducting atomic force/scanning Kelvin probe microscope for investigating charge trapping on semiconductor surfaces JAMES MOORE, SEAN KENNY, Longwood University, MONIKA RUCHALA, MIKHAIL RESHCHIKOV, ALISON BASKI, Virginia Commonwealth University — A novel combination of conducting atomic force microscopy (CAFM) and scanning Kelvin probe microscopy (SKPM) was used to investigate charge trapping and transfer on semiconductor surfaces. CAFM is first used to locally inject charge at an oxide/semiconductor interface, and then SKPM is performed to monitor the evolution of the resulting surface potential. In a dark environment, the additionally charged interface states due to CAFM charge injection result in additional band bending that persists for hours in GaN, ZnO and Si. Specifically for GaN, a model based on a tunneling mechanism was used to describe the CAFM charge injection, where electrons travel from the tip through an oxide barrier and become trapped at the interface. The decrease in induced band bending with time shows a logarithmic behavior, similar to transients produced after exposure to light. This combination of techniques offers a relatively simple method for investigating induced band bending on semiconductor surfaces and could become a useful tool for understanding concentrations of charged surface states. Specifically, current collapse in GaN FETs and HFETs has been linked to concentrations of charged surface states at the contacts.

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