Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

A defect relaxation model for the carbon vacancy in SiC

JAMIYANAA DASHDORJ, MARY ELLEN ZVANUT, Physics Department, University of Alabama at Birmingham — Deep level intrinsic defects in high purity semi-insulating SiC play in important role in electrical compensation necessary to achieve high resistivity. We use a constant light intensity approach to steady-state photo-electron paramagnetic resonance (EPR) and time-dependent photo-EPR to study the ionization cross sections and relaxation energies of the well-studied defect, the positively charged carbon vacancy, V_c^+. As-grown 4H-SiC samples with room temperature resistivity of 10^{10} Ohm-cm were studied at 4 K and 80 K. The shape of the absorption curve for V_c^+, as revealed by the steady state measurements, has a peak at 2.3 eV and photo-threshold at 1.8 eV. We interpret the difference between these two values as a structural relaxation upon release of an electron from the defect to conduction band. Consistently, preliminary time-dependent measurements reveal a Franck-Condon transition at 2.3 eV for release of an electron from the defect to the conduction band, and a second Franck-Condon transition at an energy greater than 1.3 eV for capture of electron at the defect from the valence band. The difference of no more than 1 eV may be interpreted as a relaxation energy, consistent with the interpretation of steady-state data. The details of the experimental approach and the formulation of the relaxation model will be presented.

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Date submitted: 05 Dec 2007 Electronic form version 1.4