Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Direct observation of zinc vacancies and oxygen vacancies in an electron-irradiated ZnO crystal S. M. EVANS, N. C. GILES, L. E. HALLIBURTON, Dept. of Physics, West Virginia University, L. A. KAPPERS, Dept. of Physics, University of Connecticut — Electron paramagnetic resonance (EPR) has been used to monitor zinc vacancies and oxygen vacancies in a ZnO crystal irradiated near room temperature with 1.5 MeV electrons. Out-of-phase detection at 30 K greatly enhances the EPR signals from these vacancies. After electron irradiation, but before illumination, Fe^{3+} ions and nonaxial singly ionized zinc vacancies are observed. Illumination with 325 nm light at low temperature produces spectra from singly ionized oxygen vacancies, neutral zinc vacancies, and axial zinc vacancies. The light also produces spectra from zinc vacancies with an adjacent hydrogen (an OH^- ion). The response of the irradiated crystal to illumination wavelengths out to 750 nm is described. Wavelengths shorter than 600 nm convert the Fe^{3+} ions to Fe^{2+} ions and convert the neutral oxygen vacancies to singly ionized oxygen vacancies. Warming above 130 K in the dark reverses the effect of the illuminations. This work was supported by NSF Grant DMR-0508140. One of the authors (SME) acknowledges support from the West Virginia STEM Fellowship Program.

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Date submitted: 30 Nov 2006 Electronic form version 1.4