Abstract Submitted
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Competing Mechanisms for Temperature-Dependant Electron Relaxation in Disordered SiO_2 Layers Under Electron Irradiation[1] JR DENNISON, GREGORY WILSON, AMBERLY E. JENSEN, USU Materials Physics Group, RYAN HOFFMANN, Air Force Research Laboratory, Kirtland Air Force Base — High energy electrons incident on highly disordered insulating materials undergo quasielastic collisions that imparts both charge and energy to the material; this can excite multiple intrinsic electrons from valence band or low level trap states into the extended states of the conduction band. These excited electrons provide a significant conduction mechanism in insulators under the influence of applied fields, but quickly thermalize to shallow localized trap states just below the conduction band edge that are associated with structural (physical) or compositional (chemical) defects. Electrons in these shallow trap states can: (i) remain in these shallow trap states; (ii) be thermally re-excited into the conduction band, leading to thermally assisted charge transport, termed radiation induced conductivity (RIC); (iii) decay into deep traps well within the band gap, often emitting a photon which is termed cathodoluminescence; or (iv) decay to low level valence band or trap states through radiative or non-radiative processes. Simple theory based on thermally-assisted hopping conductivity and disordered band theory is used to link diverse temperature-dependant measurements to the transition mechanisms for electrons in the shallow states.

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