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Extending the Band Model of Disordered SiO_2 Through Cathodoluminescence Studies[1] AMBERLY E. JENSEN, J.R. DENNISON, GREGORY WILSON, JUSTIN DEKANY, USU Materials Physics Group — Optical coatings of disordered thin film SiO_2/SiO_x dielectric samples on reflective metal substrates exhibited electron-induced luminescence (cathodoluminescence) under electron beam irradiation in an ultrahigh vacuum chamber at the USU facilities. These experiments provided measurements of the absolute radiance and emission spectra as functions of incident electron energy, flux and power over a range of sample temperatures (300 K to 40 K). Early results from these experiments have led to a preliminary model of the band structure of highly disordered trapped states within the band gap of SiO_2. We now extend this model to further describe the excitation of electrons from the valence band to the conduction band and subsequent relaxation into trapped states. The model for cathodoluminescence is used to describe the experimental observations, providing a fundamental basis for understanding the dependence of cathodoluminescence on irradiation time, incident flux and energy, and sample thickness and temperature.

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