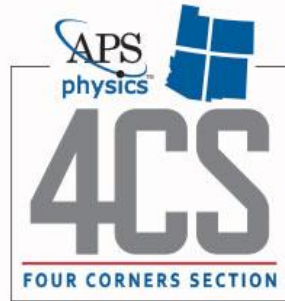


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***Cathodoluminescence Studies of the Density of States of  
Disordered Silicon Dioxide\****

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***Abstract***

Electron bombardment measurements have shown that disordered SiO<sub>2</sub> exhibits cathodoluminescence, with an overall intensity that varies with incident electron beam energy and current density, sample temperature, exposure time, and wavelength. A simple model based on the defect density of states—used to explain electron transport in highly disordered insulating materials—has been extended to predict the relative cathodoluminescent intensity and spectral radiance for disordered SiO<sub>2</sub> as a function of these variables. The spectral radiance exhibited four distinct bands, corresponding to four distinct energy distributions of defect states within the band gap; each showed different temperature dependence. These localized defect or “trap” states of disordered SiO<sub>2</sub> are due to structural or substitutional chemical defects. The cathodoluminescence data were fit with the proposed model using mean shallow trap energy, deep trap energies, saturation dose rate, and energy-dependent penetration depth as fitting parameters. The model was able to explain all the qualitative features of the data and found good agreement with the physical parameters as measured by other methods.

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