

RESEARCH ARTICLE |

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On the electrical conductivity of Ti-implanted alumina



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Article history

Ion implantation of metal species into insulators provides a tool for the formation of thin, electrically conducting, surface layers with experimenter-controlled resistivity. High energy implantation of Pt and Ti into alumina accelerator components has been successfully employed to control high voltage surface

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here we have carried out some basic investigations related to the origin of this phenomenon. By comparison of the results of alumina implanted with Ti at 75 keV with the results of prior investigations of polymers implanted with Pt at 49 eV and Au at 67 eV, we describe a physical model of the effect based on percolation theory and estimate the percolation parameters for the Ti-alumina composite. We estimate that the percolation dose threshold is about $4 \times 10^{16} \text{ cm}^{-2}$ and the maximum dose for which the system remains an insulator-conductor composite is about $10 \times 10^{16} \text{ cm}^{-2}$. The saturation electrical conductivity is estimated to be about 50 S/m. We conclude that the observed electrical conductivity properties of Ti-implanted alumina can be satisfactorily described by percolation theory.

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