THEORETICAL APPROACH TO OXYGEN ATOM DEGRADATION OF SILVER

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Based on available RBS, PIXE, and ELLIPSOMETRY data obtained on silver specimens subjected to atomic oxygen attack in low earth orbit on Flight 41-G, a theory has been developed to model the oxygen atom degradation of silver. The diffusion of atomic oxygen in a microscopically nonuniform medium is an essential constituent of the theory. The driving force for diffusion is the macroscopic electrochemical potential gradient developed between the specimen surface exposed to the ambient and the bulk of the silver specimen. The longitudinal electric field developed parallel to the gradient is modified by space charge of the diffusing charged species. Lateral electric fields and concentration differences also exist due to the nonuniform nature of the medium. The lateral concentration differences are found to be more important than the lateral electric fields in modifying the diffusion rate. The model has been evaluated numerically. Qualitative agreement exists between the kinetics predicted by the theory and kinetic data taken in ground-based experiments utilizing a plasma asher.