Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Atomic Layer Deposition Films as Diffusion Barriers for Silver Artifacts[1] AMY MARQUARDT, Department of Materials Science and Engineering, University of Maryland, College Park, MD, 20742, ERIC BREITUNG, Library of Congress, Washington D.C., TERRY DRAYMAN-WEISSER, GLENN GATES, Walters Art Museum, Baltimore, MD, GARY W. RUBLOFF, RAY J. PHANEUF, Department of Materials Science and Engineering, University of Maryland, College Park, MD, 20742 — Atomic layer deposition (ALD) was investigated as a means to create transparent oxide diffusion barrier coatings to reduce the rate of tarnishing for silver objects in museum collections. Accelerated aging by heating various thicknesses (5 to 100nm) of ALD alumina (Al_2O_3) thin films on sterling and fine silver was used to determine the effectiveness of alumina as a barrier to silver oxidation. The effect of aging temperature on the thickness of the tarnish layer (Ag_2S) created at the interface of the ALD coating and the bulk silver substrate was determined by reflectance spectroscopy and X-Ray Photoelectric Spectroscopy (XPS). Reflectance spectroscopy was an effective rapid screening tool to determine tarnishing rates and the coating's visual impact. X-Ray Photoelectric Spectroscopy (XPS), and Time of Flight Secondary Ion Mass Spectroscopy (ToF-SIMS) analysis showed a phase transformation in the Ag_2S tarnish layer at 177 $^\circ$C and saturation in the thickness of the silver sulfide layer, indicating possible self-passivation of the tarnish layer.

[1]Work supported by the NSF under SCIART collaborative research grant #DMR1041809.

Shy-Hauh Guo
Department of Materials Science and Engineering,
University of Maryland, College Park, MD, 20742

Date submitted: 22 Nov 2011 Electronic form version 1.4