

SYNCHROTRON X-RAY SCATTERING STUDIES OF THIN FILM INTERFACE EVOLUTION

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To study the evolution of surface (interface) roughness with annealing, a series of Cu thin films with thicknesses of 28nm to 158nm, encapsulated in SiO₂ and Ta/SiO₂, were sputter deposited onto thermally oxidized Si wafers. Synchrotron X-ray scattering methods were subsequently used to assess the interfacial evolution of these thin film systems. More specifically; specular x-ray reflectivity was used to separately determine the root mean square roughness for both the upper and lower Cu/SiO₂ (or Cu/Ta) interfaces. The lateral correlation length of the roughness was studied by diffuse x-ray reflectivity. Notable differences in the roughness evolution between upper and lower interfaces were observed for SiO₂ encapsulated thin films. The Ta encapsulated films evolve little as compared to the SiO₂ encapsulated films, consistent with the lower diffusivity of Cu in the Cu/Ta interface.