X-Ray Residual Stress Gradient Analysis in Annealed Silver Thin Films Using Asymmetric Bragg Diffraction

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Residual stresses were determined in magnetron-sputtered Ag thin films of 400 nm thickness by asymmetric Bragg scattering. The corresponding $\cos^2 \alpha \sin^2 \psi$ plots were nonlinear which indicates a strong residual gradient along the depth of the samples. The in-plane stress was highly compressive at the sample surface and became tensile at the interface. The out-plane stress was compressive and reached its maximum at the sample interface. The stress gradient changed significantly with post-annealing temperature. A Young's modulus of $E = 83$ GPa and a Poisson ratio of $v = 0.3$ were measured by surface acoustic wave dispersion.

Key words: Residual Stress Gradient; Thin Films; X-Ray Scattering; Surface Acoustic Wave; Grazing Incidence Diffraction.