Residual stress on $Cr_{99}Al_1$ polycrystalline thin films

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The magnetic phase diagram of bulk $Cr_{100-x}Al_x$ shows interesting properties, including a possible quantum criticality at $x \approx 2$ [1]. As the magnetic properties of Cr is influenced by dimensionality, stress and strain [2], this study focusses on polycrystalline $Cr_{99}Al_1$ thin films. Samples were prepared on fused silica using sputtering techniques and varied in thickness (t) from 29 to 452nm. Resistance measurements in the range 2 to 400 K show no anomalies and it is presumed that the Néel temperatures exceed 400 K. In-plane stresses in these films were studied using the X-ray diffraction $sin^2\psi$-method, where ψ is the tilt angle of the sample [3]. The in-plane residual strain present in the coatings (ϵ) were determined, followed by the residual stress (σ). Results indicate that σ is influenced by dimensionality and increases with t reaching a maximum for t =110 nm, where after it decreases for the thicker samples.

References:

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