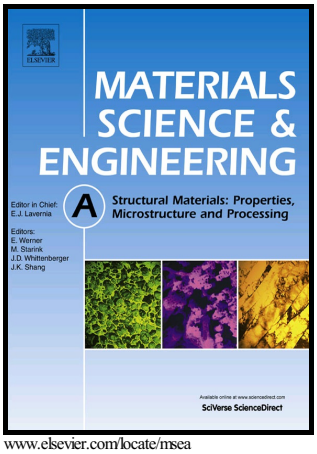

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Thickness dependence of the electro-mechanical response of sputter-deposited Mo thin films on polyimide: Insights from *in situ* synchrotron diffraction tensile tests

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Abstract

The *in situ* characterization of the deformation and fracture behavior of brittle metal films is of great technological interest for many modern applications. A prominent example is the field of flexible electronics, which rely on the electrical and mechanical integrity of metal thin films on compliant substrates when exposed to straining or bending. Within this work, failure mechanisms, such as cracking and buckling, were studied as a function of film thickness and correlated with the elastic-plastic material response during straining. Mo thin films were synthesized with thicknesses between 40 and 500 nm on polyimide substrates using an industrial scale in-line direct current magnetron sputtering system. *In situ* synchrotron X-ray diffraction was employed to determine the evolution of lattice strain and film stress during uniaxial tensile straining while simultaneously measuring the change in electrical resistance. The results highlight that the electro-mechanical properties of Mo thin films scale with the