

Quantifying the influence of halides on the surface roughness of electrodeposited polycrystalline Cu films

M. Wood¹, P. J. Heard² and W. Schwarzacher¹

¹H. H. Wills Physics Laboratory, Tyndall Avenue, Bristol BS8 1TL U.K.

²Interface Analysis Centre, 121 St. Michael's Hill, Bristol BS2 8BS U.K.

We have studied the influence of sub-millimolar quantities of halide additives on the surface roughness evolution of Cu films electrodeposited from acid sulphate electrolytes. Using scaling analysis, we find that the roughness evolution is strongly correlated with the halide adsorption energy. For thin ($< 8 \mu\text{m}$) films deposited at relatively low overpotentials from an electrolyte with either no halide or the addition of 0.25 mM of KF, KCl, or KBr, the local growth exponent, β_{loc} , which describes how the small-scale roughness depends on film thickness, increases with decreasing halide adsorption energy, being largest for KF and in the absence of halide. Even when β_{loc} is large, the increase in small-scale roughness with film thickness is a transient phenomenon, as saturation is observed for the thickest films, in agreement with previous studies. A comparison of X-ray diffraction data for films grown and without Cl⁻ present shows that the thickness dependence of the texture is similar in both cases. However, the grain size for films grown with Cl⁻ present is significantly larger.