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LOW TEMPERATURE TENSILE DEFORMATION OF THIN FILMS*

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Low temperature deformation of evaporated aluminum thin films has been investigated by means of a unique tensile testing apparatus developed for this purpose. The stress–strain curves under uniaxial tension show at least two distinct stages: (a) an elastic-like stage with a slope of approximately $E/4$ (stage I); and (b) a dynamic recovery stage with little or no work hardening (stage II). The total strain to fracture is about 0.07, and is apparently independent of temperature. The dynamic recovery stage has been analyzed in terms of vacancy or diffusion creep[1, 2], and is experimentally found to be very sensitive to the deposition conditions, grain size, strain rate and test temperature. At temperatures up to 375 °K, grain boundary diffusion creep with an activation energy of 0.66 eV has been found to be the dominating process. At even higher temperatures (525 °K) volume diffusion creep with an activation energy of 1.40 eV predominates.

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2 C. Herring, *J. Appl. Phys.*, *21* (1950) 437.

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