ABSTRACT

Electrical, magnetic and mechanical properties of crystals are drastically altered on aging them for a sufficient length of time at moderately high temperatures or even at room temperature. This happens because of e.g. the redistribution of solid-solution crystals leading to partial ordering, the coarsening of finely dispersed precipitates in alloy crystals, and the migration of point defects such as vacancies, residual gaseous and metallic impurity atoms etc. to the cores of edge dislocations in nominally pure metals during the aging time. In the present work we have studied the effect of natural aging on the mechanical properties, e.g. yield strength, tensile strength, ductility, stress-relaxation at given strain, strain-rate sensitivity of flow stress etc. of high-purity molybdenum polycrystals. It is found that natural aging reduces the ductility of Mo by a factor of 4. The yield stress and UTS for a given strain-rate are decreased on natural aging by about 20%. The yield stress increases with the imposed tensile strain-rate in accord with the power law predicted by the KPN model of plastic flow in crystals. The rate process of stress relaxation is vacancy migration; the relaxation rate s for a given initial stress level σ_o at which deformation is interrupted to observe stress relaxation, is faster in aged specimens compared with that in unaged ones. Similarly, strain-rate sensitivity of flow stress is also effected by natural aging.