Work-hardening of Foil Crystals of Copper

Work-hardening of Foil Crystals of Copper*

Kôji SUMINO and Mikio YAMAMOTO

The Research Institute for Iron, Steel and Other Metals

Abstract

An investigation has been made on the plastic properties of recrystallized copper foil crystals of which thicknesses are down to 6.6 microns. It has been found that stress-strain curves of single crystal and pseudo-single crystal (crystal having the cube-texture) specimens thicker than 50 microns consist of three deformation stages in a quite similar way to those of bulk single crystals and that the value of the work-hardening rate in the stage II of deformation decreases very sensitively with decreasing specimens thickness. Pseudo-single crystal specimens thinner than about 10 microns do not reveal the stage II of deformation, but the work-hardening rate takes a very high value when the tensile axis approaches to the [001] direction. The work-hardening rate of the well-developed stage II in 50.8 microns thick specimens elongated in directions near [011] is much lower than that observed in the specimens elongated in directions near [001]. A large fraction of slip lines observed on (100) surfaces of the foil crystals are clustered in early stages of deformation. This clustered distribution of slip lines becomes more remarkable with increasing strain when the tensile direction of the specimens is near [001]. On the contrary, when the specimens are elongated in directions near [011], the distribution of slip lines tends to be uniform as the deformation becomes larger. Some considerations are made on the mechanism of work-hardening on the basis of possible interactions between dislocations operating during deformation.

* The **1117th** report of the Research Institute for Iron, Steel and Other Metals. Published in the Journal of the Physical Society of Japan, **18 S-I** (1963), 73. (Proceedings of the International Conference on Crystal Lattice Defects 1962, Symposium)