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On the Formation of Striation-Type Substructure in Copper Crystals*

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Abstract

The striation formation in copper crystals grown at the rate of 1 mm/min by the horizontal zone melting method was studied by a dislocation etch pit technique. It was found that the formation of striations depended upon the crystallographic orientation, the density and distribution of dislocations in a seed crystal and the axial temperature gradient. The [110] crystals showed a marked tendency to develop the striations, while the [111] and [100] crystals exhibited ordinarily a weak tendency of the striation formation. In the latter two crystals, the inoculation with seed crystals which were, slightly damaged could result in growing the striated crystals, while no striations were formed when the seed crystals were not damaged. With a low dislocation density seed, the striations were not formed in the [111] crystal grown under a low axial temperature gradient, though a fine network of subboundaries appeared. On the other hand, the striations were formed after an incubation distance of 1 cm when the [111] crystal was grown under the same thermal conditions but with a high dislocation density seed crystal containing a fine network of subboundaries. However, under a high axial temperature gradient, no striations were built up, even if the crystal was grown with a high dislocation density seed crystal. Observations of the dislocation etch pits revealed that the striations were formed when the coalescence of small angle tilt boundaries, which arranged closely in parallel, occurred.

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