Growth and Perfection of Nickel and Cobalt Single Crystals Using the Floating-Zone Method(Physics)

ranging from 0.1 to 29.0 mm/min and with cooling rates of the crystal after growth varying from 0.24 to 45°C/min. It was found that the growth rate had a very important effect on the generation of dislocations and their arrays, but the cooling rate of the crystal after growth had an important effect only when the crystal had been solidified at a rate of 0.1 mm/min.

Growth and Perfection of Nickel and Cobalt Single Crystals Using the Floating-Zone Method

S. HAYASHI, J. ECHIGOYA, H. HARIU, T. SATÔ, T. NAKAMICHI and M. YAMAMOTO
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Using the floating-zone method, Ni and Co single crystals were grown under various experimental conditions. Detailed observations of low angle boundaries or striations and of the dislocation arrangements in the grown crystals were carried out using an optical microscope. Ni single crystals grew preferentially along the ⟨111⟩ direction and were striation-free. As the growth direction deviated from the ⟨111⟩, sharp striations were formed. The dislocation density in the crystals was about 10^6 cm^{-2}, which were distributed at random. Co single crystals grew along the ⟨0001⟩ direction and were also striation-free. As the growth direction deviated from the ⟨0001⟩, many striations were formed with more complex shapes. These experimental results are discussed on the basis of the growth mechanism of crystals and of dislocation behaviour during the solidification process.

Crystal Structures, Homogeneity Ranges and Magnetic Properties of Tantalum-Cobalt Laves Phases

Hiroshi ITOH, Yoshihira AOKI, Takurô NAKAMICHI and Mikio YAMAMOTO
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The crystal structures, homogeneity ranges and magnetic properties of the three Laves phases in the tantalum-cobalt alloy system have been studied with the aid of the X-ray powder photographs, density and magnetic measurements. The hexagonal $MgNi_2$-type $TaCo_2$ compound with the homogeneity range of about 25.5 to 27.0 at.% Ta, is ferromagnetic with Curie temperatures lower than 19 K and saturation magnetizations at 4.2 K less than 3.58 emu/g. The cubic $MgCu_2$-type one is paramagnetic down to 4.2 K over the whole homogeneity range of about 28.5 to 33.3 at.% Ta. If a relatively strong temperature-dependent magnetic susceptibility of the stoichiometric composition in this compound is analyzed as the band paramagnetism, excess cobalt atoms seem to have very small localized moments in the non-stoichiometric one. Around 40.0 at.% Ta one observed a hexagonal $MgZn_2$-type which shows Pauli-paramagnetism with the smallest magnetic susceptibility among the three Laves phases.