Effects of Growth Rates and Cooling Rates on Defect Generation in Melt-Grown Copper Crystals(Physics)

Abstracts of Papers Published in Other Journals

Physics

Theory of the Giant Magnetostriction in Fe_2TiO_4

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The anomalous properties of Fe_2TiO_4, i.e. (i) the giant magnetostriction ($(c-a)/a=7.5\times10^{-3}$ at 77 K), (ii) the anomalously small elastic constant $(c_{11}-c_{12})$, and (iii) the positive magnetic anisotropy constant, are explained by taking into account both the Jahn-Teller effect of Fe^{2+} ions in the A-sites of the spinel structure and the spin-lattice coupling of Fe^{2+} ions in the B-sites. It is shown that when the direction of the Jahn-Teller distortion is determined so as to lower the energy of the coupling between the spins in the B-sites and local distortions due to the Jahn-Teller effect, the Jahn-Teller distortion itself behaves as if it were a giant magnetostriction. The temperature dependences of the distortion, elastic constants and the specific heat are calculated. It is found that $(c_{11}-c_{12})$ has a minimum and the excess specific heat due to the Jahn-Teller ions has a maximum below the Néel temperature. Discussions on the magnetic anisotropy constant are also given.

Temperature and Frequency Dependences of Line Width of Antiferromagnetic Resonance in Europium Telluride

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J. Phys. Soc. Japan, **37** (1974), 57.

EuTe is a second kind f.c.c. antiferromagnet. The line width of the antiferromagnetic resonance of the single crystal has been measured at frequencies of 9.20, 22.12, and 33.99 GHz in the temperature range between 1.25 and 4.20 K. The measurements have been performed on the spin-flop mode with the resonance field applied in the easy plane (111). The results show that the temperature dependence of the line width strongly depends on the used frequency. The line width at 9.20 GHz increases with temperature as $\exp(-5/T)$, the one at 22.12 GHz increases linearly with T, and at 33.99 GHz it increases very slowly with T. The essential behavior of the temperature and frequency dependences is theoretically explained in terms of the three-magnon process derived from the exchange interaction.

Effects of Growth Rates and Cooling Rates on Defect Generation in Melt-Grown Copper Crystals

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J. Cryst. Growth, **24/25** (1974), 418.

Single crystals of zone-refined Cu were grown from the melt at growth rates

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

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J. Crystal Growth, **24/25** (1974), 422.

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
Z. Metallkunde, **65** (1974), 149.

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.