Crystallization Process of Iron-, Nickel-, and Cobalt-Based Amorphous Alloys Containing Silicon and Boron(Metallurgy)

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Structural changes during heating or aging in a wide temperature range were exmained with three amorphous alloys of $Fe_{78}Si_{10}B_{12}$, $Ni_{75}S_8B_{17}$ and $Co_{75}Si_{15}B_{10}$ by measurements of electrical resistance, differential scanning calorie and Vickers hardness and also by transmission electron microscopy and X-ray diffraction.

The results obtained are summarized as follows:

(1) The crystallization process of three amorphous alloys is divided into four stages: (a) the incipient stage of crystallization where a certain short range ordering of atoms occurs, (b) the formation of primary metastable phases (MS-I), (c) the formation of secondary metastable phase (MS-II) with complex single structures, and (d) the formation of a stable phase consisting of a mixture of each equilibrium phase. The MS-I phase appears in the amorphous matrix in a manner of homogeneous nucleation and gradual growth, while the MS-II phase grows rapidly from a few nuclei and completely spreads over the amorphous matrix containing the MS-I phases. At higher temperatures, these MS-II phases transform finally to stable phases.

(2) The temperature-time-transformation diagrams of three alloys were constructed. In these diagrams, distinct differences in the transformation sequence and the mode are observable in the upper and lower ranges of the critical temperature (Tx'). Above this boundary, crystallization by way of nucleation and growth proceeds through two metastable phases and finally to a stable phase. Below that temperature, on the other hand, progressive aging gradually changes the amorphous structure to the assembly of fine grains (about 100~200 Å) with a simple structure such as *b c c*, *f c c*, or *h c p*.

Low-Temperature Mechanical Properties of High-purity Molybdenum Single Crystals Doped with Carbon

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High-purity molybdenum single crystals of mid-orientation, doped with carbon, are hardness and tensile tested after various heat-treatments. Two-stage age-hardening is observed on isochronal aging. The two stages correspond to the two stages in resistivity change and are considered to be due to the formation of carbon clusters. The age-hardened crystals containing more than 10 at. ppm carbon are brittle and cleaved along approximately {100} in a tensile test at 77 K. Above 179 K, an aged specimen containing 300 at. ppm carbon is ductile. Work-softening is observed in as-quenched specimens tested at 77 K and in aged crystals with more than 300 at. ppm carbon tested at the ductile temperature range. The yield stresses of brittle crystals and those showing work-softening are larger than 1100