MULTIVARIANT NATURE OF MARTENSITIC STRUCTURES IN COPPER BASED SHAPE MEMORY ALLOYS

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Abstract

Shape memory effect is an unusual property exhibited by certain alloy systems, and leads to a solid state phase transition, martensitic transformation. Copper based alloys exhibit this property in beta phase field, which have bcc- structures at high temperature. These alloys undergo martensitic transition on cooling.

Martensitic transformations are first order diffusionless transitions and occur in a few steps with the cooperative movement of atoms by means of lattice invariant shears on a \{110\} - type plane of austenite matrix which is basal plane of martensite. First one is Bain distortion, and second one is homogeneous shears, lattice invariant shears which occur on a \{110\}-type close packet plane of austenite matrix. The lattice invariant shears occurs, in two opposite directions, \langle 110 \rangle -type directions on the \{110\}-type basal plane. This kind of shear can be called as \{110\} \langle 110 \rangle -type mode and has 24 variants. This lattice invariant shear gives rise to the formation of layered structure. Product phase in this transition has the unusual layered structures which consist of an array of close-packed planes with complicated stacking sequences called as 3R, 9R or 18R martensites depending on the stacking sequences on \{110\}- type planes of parent phase.

In the present contribution, x-ray diffraction and transmission electron microscopy studies were carried out on two copper based ternary alloys.

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