The role of ageing treatments in shape memory behaviour of copper based shape memory alloys

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The behaviour of shape memory alloys is evaluated on the basis of structural changes on the microscopic scale. Metastable beta phases of copper-based ternary alloys are very sensitive to heat treatments and transform martensitically from the ordered structure to the long-period layered structures on cooling. Also, the fundamental properties of these alloys are altered by aging in the martensitic state. Therefore, it is important to understand and control the effect of ageing from the viewpoint of stability which is essential in applications. The ageing gives rise to structural changes in both, long and short-range order in the materials. Martensitic transformations in copper based beta phase alloys occur in a few steps, like Bain distortion and two or more lattice invariant shears on a (0 0 1)-type plane of the austenite matrix, which is a basal plane or stacking plane of the martensite. With these distortions, 9R (or 18R)-type martensites originate from one of the basal planes. The martensitic transformations are diffusionless and exhibit the order of the parent phase existing prior to the martensitic transformation. The martensite phase has also an unusual layered structure which consists of an array of close-packed planes with complicated stacking sequences referred to as 3R, 9R or 18R martensites depending on the stacking sequences on the close-packed planes of the matrix. In the present contribution, x-ray diffraction and transmission electron microscopy studies were carried out on two copper based ternary alloys. Keywords: Shape memory effect, martensite, atom sizes, layered structures.