**Crystallography of Microstructural Transitions in Copper Based Shape Memory Alloys**

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The behaviour of some materials is evaluated by the structural changes in microscopic scale. Shape-memory alloys are a typical class of such materials, which have the modified crystal structures in the transformed case and exhibit a peculiar property called shape memory effect. A series of copper based alloys and nearly equiatomic NiTi alloys exhibit this peculiar property which involves the repeated recovery of macroscopic shape of material in β(bcc) phase region. Metastable β-phases of noble metal copper based ternary alloys are very sensitive to the heat treatments and transform from the B2(CsCl) or $DO_3(Fe_3Al)$ type ordered structures to the multilayered structures in martensitic manner on cooling. In case these alloys are deformed in a temperature range in martensitic condition they change in shape and recover the undeformed original austenitic shape on heating over the reverse transition temperature after removing the strain. These materials regain the deformed shape on cooling to the martensitic state and cycle between deformed and undeformed shapes on cooling and heating. Therefore this property is called reversible shape memory effect.

Martensitic transformations in shape memory alloys occur by two or more lattice invariant shears on a $\{110\}_\beta$ plane of parent phase called basal plane of martensite. The order of martensite structure is closely related to the order of parent due to the diffusionless character of the transformation, and the martensite exhibits the order of parent existing prior to the transformation. Martensite phase 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 the close-packed planes of the ordered lattice. On the basis of austenite-martensite relation, it is experimentally determined that the basal plane of 9R (or 18R) martensites originates from one of the $\{110\}_\beta$ planes of the parent phase, and an homogenous shear occurs on the basal plane in either of two opposite directions during the transformation.