Symposium | A. Advances in Materials Theory for Multiscale Modeling

[SY-A10] Symposium A-10

Chair: Steve Fitzgerald(University of Leeds, UK)
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[SY-A10]Stacking and Multilayered Nature of Martensite in Copper Based Shape Memory Alloys

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Shape memory effect is characterized by the recoverability of two certain shapes of material at different temperatures. These materials are often called smart materials due to the functionality and their capacity of responding to changes in the environment. Shape memory is initiated by cooling and stressing material and processed by heating and cooling.

Shape memory effect is a result of successive thermal induced and stress induced martensitic transformations. Thermal induced martensitic transformation occurs as twinned martensite on cooling as martensite variants with cooperative movement of atoms by means of lattice invariant shears on {110} - type planes of austenite matrix. Twinned structures turn into detwinned martensite by means of stress induced martensitic transformation on stressing in martensitic state. Lattice invariant shears occurs in <110 >-type directions on the {110}-type basal planes.

Copper based alloys exhibit this property in metastable β -phase region, which has bcc-based structures at high temperature parent phase field. Twinning and lattice invariant shear is not uniform in these alloys and multilayered martensite with complex stacking structures, like 9R or 18R martensites occur by means of thermal induced martensitic transformation. All of these martensite phases are long-period stacking ordered structures that is the underlying lattice is formed by stacks of close-packed planes.

In the present contribution, x-ray diffraction and transmission electron microscopy studies were carried out on two copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns reveal that both alloys exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation.