ISSN: 2169-0022
Volume-12
Journal of Material Sciences & Engineering

29th International Conference on
Advanced Materials, Nanotechnology and Engineering
May 29, 2023 I Webinar
https://advancedmaterials.conferenceseries.com/

https://www.hilarispublisher.com/material-sciences-engineering.html

Title: Crystallographic aspects of shape memory effect and super elasticity in shape memory alloys

Adiguzel O
Firat University, Turkey

Received: May 19, 2023 Accepted: May 21, 2023; Published: May 29, 2023

Shape memory alloys take place in advanced smart materials, by exhibiting a peculiar property called shape memory effect, which is characterized by the recoverability of two certain shapes of material at different conditions. These alloys have dual characteristics called thermo elasticity and super elasticity, from viewpoint of memory behavior. Shape memory effect is initiated with thermo mechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of materials cycles between original and deformed shapes in reversible way in bulk level. Therefore, this behavior can be called thermo elasticity. Super elasticity is performed with stressing and releasing the material in elasticity limit at a constant temperature in the parent phase region and material recovers the original shape upon releasing. Super elasticity exhibits ordinary elastic material behavior, but it is performed in non-linear way; loading and unloading paths are different at the stress-strain diagram and hysteresis loop refers to energy dissipation. These phenomena are result of crystallographic transformations called martensitic transformation.

Thermo elasticity is governed by the thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with the cooperative movements of atoms in <110>-type directions on the {110}-type planes of austenite matrix and ordered parent phase structures turn into twinned martensite structures along with lattice twinning reactions. The twinned structures turn into detwinned structures, by means of stress induced martensitic transformation with deformation. Super elasticity is also governed by stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structures with stressing.

On heating after these treatments, detwinned martensite structures turn into the ordered parent phase structures, by means reverse austenitic transformation. Twinned structures are result of lattive invariant shears on {110}-type planes of austenite matrix. Atomic movements are confined to the nearest atom distance and these transformations are diffusion less transformations. Super elasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into the detwinned martensite structures with stressing. Lattice twinning and detwinning reactions play important role at martensitic transformations. These alloys are functional materials with these properties and used in many fields, from biomedical to the building industry.

Copper based alloys exhibit this property in metastable beta-phase region, which has bcc based structures at the parent phase field. Lattice invariant shear twinning is not uniform in these alloys and cause the formation of complex layered