Thermoresponsive Reactions and Dual Characteristics of Shape Memory Alloys

Osman Adiguzel
Firat University, Turkey

A series of materials take place in class of advanced smart materials with adaptive properties and stimulus response to the external changes. Shape memory alloys take place in this group, due to the shape reversibility and capacity of responding to changes in the environment. These alloys exhibit a peculiar property called shape memory effect, which is characterized by the recoverability of two certain shapes of material at different temperatures. Shape memory effect is initiated by thermomechanical cooling and stressing treatments on the material and performed thermally on heating and cooling. This behaviour can be called thermoelasticity. The material recovers original shape on heating, and shape of material cycles between deformed and original shape on cooling and heating in bulk level. This is the result of thermoresponsive reactions, and this behaviour can be called thermoelasticity. These alloys have dual characteristics called thermoelasticity and superelasticity, from viewpoint of memory behaviour. Two successive structural transformations, thermal and stress induced martensitic transformations govern shape memory phenomena in crystallographic basis. Thermal induced martensitic transformation occurs with the cooperative movement of atoms in □110>- type directions on {110}-type planes of austenite matrix, by means of shear-like mechanism, and ordered parent phase structures turn into twinned martensite structures. Stress induced martensitic transformations occur along with crystal or lattice detwinning reaction by stressing material in low temperature condition, and twinned structures turn into detwinned martensite structures. Upon cooling after these treatments, detwinned martensite structures turn into ordered parent phase structure by means of reverse austenite transformation. Superelasticity is performed by stressing and releasing material at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing the applied stress. Superelasticity exhibits the normal elastic materials, but it is performed in non-linear way; stressing and releasing paths are different in the stress-strain diagram, and hysteresis loop refers to energy dissipation. These alloys are used in building industry, against to the seismic events, due to this property.

Biography

Dr Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. He worked as research assistant, 1975-80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has already been working as professor. He published over 80 papers in international and national journals; He joined over 100 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last seven years (2014 - 2020) over 80 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. He supervised 5 PhD- theses and 3 M.Sc.- theses.

oadiguzel@firat.edu.tr