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Abstract

Lattice Reactions and Nanoscale Aspects of Reversibility in Shape Memory Alloys

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Abstract:
Shape memory effect is a peculiar property exhibited by a series of alloy system, called shape memory alloys, and this property 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 capacity of responding to changes in temperature. These alloys are used as shape memory devices in many fields, such as medicine, bioengineering, metallurgy, building industry and many engineering fields. Shape memory effect is result of successive thermal and stress induced phase transformations characterized by changes in the crystal structure of the material. These transformations are governed by lattice reactions in crystallographic and nanoscale level in the material. Thermal induced martensitic transformation is first order lattice-distorting phase transformation, and thermally occurs with cooperative movements of atoms by means of lattice invariant shear, on cooling from parent phase region. Thermal induced martensite occurs as twinned martensite by lattice twinning, and the twinned structures turn into the detwinned structures by means of stress induced martensitic transformation, by stressing material in the martensitic condition. Shape memory alloys become noticeable as smart materials in mechanical applications in many fields of industry. These alloys have dual characteristics and exhibit another property called superelasticity which is performed by stressing material at constant temperature in parent phase region just over the austenite finish temperature. Superelastic materials are deformed in the parent phase region and, shape recovery is carried out instantly and simultaneously upon releasing the applied stress. This property exhibits classical elastic material behaviour, but stress-strain behaviour is different; the stressing and releasing paths are different and hysteresis loop refers to the energy dissipation.

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 60 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 six years (2014 - 2018) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. He supervised 5 PhD- theses and 3 M.Sc- theses. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

Recent Publications:

1. Crystallography of microstructural transitions in copper-based shape memory alloys.
2. Premartensitic and martensitic transitions and crystallography in copper based shape memory alloys.
3. Smart materials and the influence of atom sizes on martensite microstructures in copper-based shape memory alloys.
4. Crystallography of layered structures of martensite in copper-based shape memory alloys.

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