

Crystallographic Basis of Thermal and Mechanical Reversibility in Shape Memory Alloys

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Abstract

Shape memory effect is a peculiar property exhibited a series of alloy system called shape memory alloys, which have dual characteristics called thermoelasticity and superelasticity, from viewpoint of memory behavior. These alloys take place in class of advanced novel materials with these properties and response to the external conditions. Two successive crystallographic transformations, thermal and stress induced martensitic transformations govern these phenomena in crystallographic basis. Shape memory effect is performed thermally in a temperature interval on heating and cooling after first cooling and, this behavior can be called thermal memory or thermoelasticity. Superelasticity is performed mechanically by stressing and releasing at a constant temperature in the parent austenite phase region of materials, and this behavior can be called mechanical memory. Thermal induced martensite occurs along with lattice twinning and ordered parent phase structures turn into multivariant twinned martensite structures in self-accommodating manner, and twinned martensite structures turn into detwinned martensite by means of stress induced martensitic transformation on stressing. Superelasticity is performed by stressing material and releasing in a constant temperature in parent phase region and performed simultaneously upon releasing the applied stress. This phenomenon is performed in non-linear way; stressing and releasing paths are different in the stress-strain diagram, and hysteresis loop refers to energy dissipation.

Received: February 13, 2022; **Accepted:** February 21, 2022; **Published:** March 31, 2022

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 been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He published over 80 papers in international and national journals; He joined over 120 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 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 70 online conferences in the same way in pandemic period of 2020-2021. 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.

This Abstract is taken from: [35th International Conference on Nanomaterials and Nanotechnology](#) | March 25-26, 2022 | Berlin, Germany