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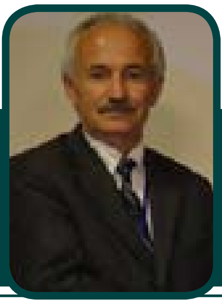

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Physical basis and atomic scale aspects of displacive transformations of shape memory alloys

Shape memory alloys are stimulus respective materials to external effects like temperature changes and stressing. These alloys can be used temperature responsive materials due to this property. Shape memory effect is governed successive thermal and stress induced martensitic transformations. These alloys take place in class of smart materials, due to this property. Martensitic transformations are first order displacive transformations and the product phase inherits the order of parent phase. Two crystallographic reactions, lattice twinning and detwinning, govern shape memory effect. Thermal induced martensite occurs as twinned martensite by means of lattice invariant shear, and the twinned structures turn into the detwinned structures by means of stress induced martensitic transformation by deforming material in the martensitic condition. The crystal structures of materials cycle between ordered parent phase and detwinned martensitic structures, whereas the material cycles between original and deformed shapes in bulk level, on heating an cooling, respectively. Martensitic structures in β-phase alloys are closely related to the austenite structures and inherit the order in the parent phase due to the displacive character of transformation. Biocompatibility of these alloys is one of the most important properties related to their biomedical applications as orthopedic implants, stent as well as orthodontic devices. In the present contribution, basic mechanism of martensitic transformation and shape memory phenomena are described from the viewpoints of physical and crystallographic basis. Experimental studies were employed in copper based shape memory alloys, which exhibit this property in β- phase region, and they are widely used as shape memory component in devices. Lattice twinning and lattice invariant shears occur in non-uniform way in copper based shape memory alloys, and this process causes to the formation of the long period complex layered structures. X-ray diffraction, transmission electron microscope and differential scanning calorimeter (DSC) studies were carried out on two copper based ternary alloys. The x-ray diffractograms taken in a long time intervals from the aged specimens at room temperature reveal the structural changes in diffusive manner. In conclusion, one can say that shape memory alloys become noticeable as smart materials in the biomedical field as well as mechanical application in many fields of industry.

Biography

Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey in Solid State Physics with experimental studies on diffusionless phase transformations in Ti-Ta alloys in 1980. He has studied at Surrey University, Guildford, UK, as a post doctoral research scientist in 1986-1987, and He studied on shape memory alloys. He worked as research assistant, 1975-80, at Dicle University, Diyarbakir, Turkey. He moved to Firat University in 1980, and became professor in 1996, and He has already been working as professor. He published over 50 papers in international and national journals; He joined over 80 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 three years (2014 - 2016) over 20 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. He supervised 5 PhD- theses and 3 M.Sc- theses 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 which is being 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.

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