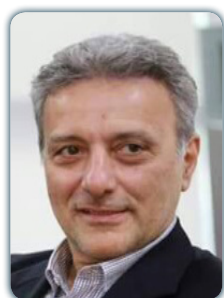


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On the two way shape memory effect of NiTi/NiTiCu bi-layer composites: Experimental and numerical study

NiTi/NiTiCu Bi-layer composite as a bulk novel material, which shows pseudo-elastic and shape memory properties simultaneously was made by Diffusion bonding method. In addition similar bi-layer but thin film was prepared by deposition onto Si (111) substrates by RF magnetron sputter deposition from separate alloy targets. The interface of bonding of bulk material was investigated by SEM and chemical composition gradient in the interface zone analyzed using line scan analysis with energy dispersive X-ray spectroscopy. In the case of thin film, grazing incidence X-ray diffraction, transmission electron microscopy, electrical resistivity and nano-indentation were used for characterization. An analytical model and FEM study was employed in order to investigate the tensile behavior of composites during loading and subsequent unloading. The solutions of the analytical method are validated with the numerical simulations as well as the experimental results. The chemical and stress gradient in the bi-layers affects the structure, phase transformation and shape memory effect. The bi-layers exhibit multi step phase transformation and intrinsic two-way SME with a reduced hysteresis without complicated training. Considering the results of the analytical modeling, the numerical simulations and the experiments, it is evident that the bi-layer composites with different thickness ratios provide adjustable mechanical behavior that can be considered in different applications design e.g., actuators, equipped with shape memory components.

Biography

Mahmoud Nili Ahmadabadi is a Professor at University of Tehran, Iran. He is teaching and working on phase transformation of metals and alloys. Different alloys have been the subject of his research and also liquid-solid phase transformation, bulk metallic glass or solid-solid phase transformation. In the latter case, shape memory and pseudo-elasticity in Fe base or NiTi alloys is one of his recent major research subjects. In the case of NiTi alloys he and his team introduces bi-layer bulk and thin film shape memory NiTi alloys which show intrinsic two way shape memory effect with faster response during loading and unloading.

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