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Partial transformation and the two-way shape recovery characteristics

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It is widely known that two-way memory effect (TWME) is not an inherent property of shape memory alloy. The development of TWME requires thermomechanical training. Experimental study showed that undergoing partial reverse transformation in the course of training leads to the emergence of temporal two-step transformation, which was traditionally observed in the calorimetry measurement of an arrested stress-free heating cycle. The present work introduces a macromechanical approach to explain the mechanism of two-step transformation and its associated effects on stress-assisted two-way memory effect (SATWME) and TWME. The appearance of two-step transformation was observed to be a one-time only phenomenon and it clearly disappeared in the next full transformation. The disappearance of two-step transformation highlighted the occurrence of microstructural rearrangement driven by the internal stress field in the successive training cycles. A strain comparison demonstrated that the dominance of re-transforming stress-assisted martensite (SAM) during cooling promoted the formation of internal back stress. This makes the accommodation process of deformation-induced martensite generated via pre-straining and SAM difficult, owing to which immobilizes the dislocations movement in the forward transformation direction, and causes detrimental effect on the TWME.

Biography

Kiyohide Wada received BEng. honours degree from University of Glasgow, UK in 1999, and PhD in Mechanical and Aerospace Engineering from Nanyang Technological University, Singapore in 2008. He was involved in various commercial satellite space programs between 2009 and 2013. Currently, he is a Senior Lecturer of Aerospace Engineering Portfolio, College of Engineering at the Swansea University. His research interest includes shape memory alloys (SMAs), application of SMAs in mechanical and aerospace engineering, low-shock hold and release mechanisms, and deployable antenna structures.

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