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Determination of Phase Transformation Yield Surface of Anisotropic Shape Memory Alloys

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The superelastic behavior of Shape Memory Alloys (SMA) is useful for several industrial applications. To determine the behavior of SMA structures, the development of specified phenomenological constitutive models is necessary. In particular, the definition of the criterion in order to detect the elastic behavior from the non-linear one related to the martensitic transformation is required. Recently, a macroscopic model, based on the concept of two transformation surfaces (a first surface drives the forward transformation and the second drives the reverse transformation) has been proposed and validated on a large data base of experimental results under uniaxial and multiaxial loadings. This model, in its initial version, is only valid for the pseudoelastic behavior of isotropic polycrystalline SMA. However, it is well-known that the initial crystallographic texture is an important parameter in the behavior of SMA and in particular in the shape of the transformation yield surface. The aim of this paper is to present some results concerning, on the one hand, the determination and the modeling of the transformation surface of polycrystalline textured SMA and, on the other hand, the relation between the volumic fraction of martensite and the macroscopic transformation strain. Comparisons between experiments and the two theoretical investigations will be done on Cu-Al-Zn and Cu-Al-Be polycrystalline shape memory alloys.

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