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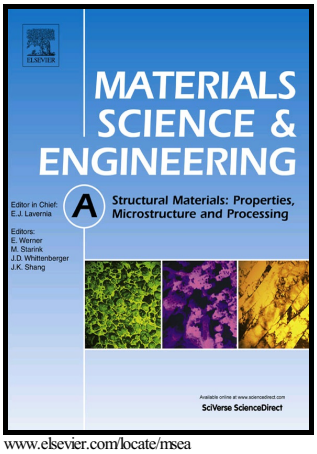

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Influence of strongly textured microstructure on the all-round shape memory effect of rapidly solidified $Ni_{51}Ti_{49}$ alloy

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Abstract

$Ni_{51}Ti_{49}$ alloy strip with all-round shape memory effect (ARSME) was obtained through rapid solidification followed by constraint-aging treatment. The high cooling rate and large temperature gradient along the thickness direction of $Ni_{51}Ti_{49}$ alloy strip yield fine columnar grains and strong fiber texture of $<100>_{B2}$ during rapid solidification. Such fine-grained and strongly textured microstructure increases the nucleation, limits the orientation and restricts the growth of Ni_4Ti_3 precipitates during constraint-aging treatment. The fine and well-aligned Ni_4Ti_3 precipitates with dispersive distribution introduce strong coherent stress field and numerous interfaces between the matrix and precipitates in the rapidly solidified and constraint-aged $Ni_{51}Ti_{49}$ alloy. Homogeneous composition and massive interfaces in the B2 matrix promote the simultaneity of local phase transformations. The strong coherent stress field and the excellent deformability of $<100>_{B2}$-oriented grains contribute to large deformation and high recovery ratio of the alloy during phase transformation. Thus, the strongly textured microstructure formed during rapid solidification allows the constraint-aged NiTi alloy to possess superior ARSME with narrow phase transformation temperature range.

Keywords: NiTi alloy; texture; rapid solidification; all-round shape memory effect; Ni_4Ti_3 precipitate