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# Current development in the study of magnetically induced crystal reorientation of Ni-Mn-Ga ferromagnetic shape memory alloy

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In the past two decades Ni-Mn-Ga Heusler alloys have received great attention as these exhibit magnetic shape memory effects, first described in 1999. Modulated Ni 2 MnGa martensite has exceptionally low stress for pseudoplastic deformation or structural reorientation by twinning mediated by highly mobile twinning boundaries [1]. Owing to large magnetic anisotropy and low twinning stress the large pseudoplastic deformation can be induced by a magnetic field. Thus, these materials can replace giant magnetostrictive materials with fast external actuation control and strain exceeding 10 % [1].
In this study, the energy needed for the deformation by a magnetic field and by mechanical force was measured and compared in monocrystalline Ni 50 Mn 28 Ga 22 modulated martensite. Measurements were conducted on five samples by vibration sample magnetometer and stress-strain device to compare directly different modes of loading. In contrast with the phenomenological model [2] the calculated energy of magnetically induced reorientation or pseudoplastic deformation were considerably higher compared to the energy needed using mechanical force. The switching field of samples with nucleated twinning boundaries was also measured and compared to single variant crystals. Results only partly support modelling of the twinning stress and switching field [1-3]. The model-data discrepancies are an unresolved issue suggesting a need for modification of the model.

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