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Experimental and theoretical investigations into the twinning energy of an FSMA system P.K. MUKHOPADHYAY, MADHUPARNA KARMAKAR, RAJINI KANTH B., LCMP, S.N.B.N.C.B.S., Kolkata 98, India, S.N. KAUL, SoP, Central University, Hyderabad 46, India — Ferromagnetic shape memory alloys (FSMA) are smart materials with largest magnetic field induced strain below austenite - martensite transformations. The lower temperature martensitic state is characterized by the presence of structural twins that have this exceptional magnetoelastic coupling. To understand this behavior, we carried out sound velocity and attenuation measurements on a typical FSMA material, NiFeAl system, and determined the Young's moduli under various stresses and associated strains. We found that the effect of stress is to alter the martensite temperature. We also studied a theoretical thermodynamic constitutive model and Clausius-Duhem inequality, to determine the stress resulting from an applied strain for an isothermal system. In the absence of an applied magnetic field the free energy of the system consists of only the mechanical energy contribution which in turn is dependent upon the elastic moduli pertaining to the elastic and twinning strains. The paper describes the details of measurements and the model chosen, along with the discussions on the correspondence between the experimental observations and various theoretically determined quantities.

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