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A Critical Criterion for Martensitic Phase Transformation Considering both Hydrostatic Pressure and Deviatoric Stress¹ SONGLIN XU, YANGBO GUO, ZHIPING TANG, Key Laboratory for Mechanical Behavior and Design of Materials (LMBD), Department of Modern Mechanics, University of Science and Technology of China — In this article, from the point of view of thermodynamic and energy, criterions for stress-induced and strain-induced phase transformation are established considering both hydrostatic pressure and the deviatoric stress. The critical surface for phase transformation predicted by the criterion is a conic surface in the principal stress space, demonstrating asymmetric property in tension and compression states. The conic critical surface of phase transition may intersect the cylindrical yield surface in the principal stress space, such intersection may induce two abnormal phenomena: (1) unloading phase transformation and (2) the transition between the stress-induced and the strain-induced phase transformations. These predictions need to be verified experimentally. Using the criterion established, the initial critical stresses of transformation for TiNi alloy and Fe-Ni alloy are predicted, the predictions are in good agreement with the experimental results, but the predicted volumetric strain for phase transformation is larger than the experimental result.

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