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George E. Duvall Shock Compression Science Award Talk: The Role of the Gibbs Function in Solid-Solid Phase Transformations Under Nonhydrostatic Stress Conditions

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Under the assumption of uniform stress and strain we can easily form the Gibbs function for each of two coexisting solid phases and there is a natural temptation to simply equate them in order to determine when the transformation will occur, as is done in the case of two fluid phases in thermodynamic equilibrium. There are a few simple geometries and morphologies for which this is legitimate, but it is not generally correct. At the high end of the "rigorous" spectrum there is the rational thermodynamics generalization involving the *electrochemical tensor* that holds at any point on an arbitrary interface between two solid phases under completely general conditions. However, this seems to be of limited use in attempting to define global conditions for a transformation. Various cases are examined in order to shed light on a practical question that has been around the shock-wave community for a long time, and one that would benefit from quantitative examination.

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