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**A formulism of two-phase equilibrium and phase diagram for
elastic-plastic deformed system under non-hydrostatic stress
conditions: Formulations and verification**

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Abstract

Phase equilibrium, phase diagram and phase transformation of a solid that undergoes elastic-plastic deformation under non-hydrostatic stress conditions have technical and scientific significance, and numerous experimental and theoretical studies have been performed on this issue; however, a comprehensive theoretical description remains an unresolved problem. The crucial obstacle lies in seeking the phase equilibrium conditions, especially the formula of the general chemical potential. Duall and Graham (1977) specified that it is impossible to construct a general Gibbs function, i.e. a general chemical potential, to define the equilibrium conditions for phase transformation when shear stress is present, except for some particular cases. This work focuses on the phase equilibrium problem of a solid-solid two-phase system, which permits elastic-plastic deformation under non-hydrostatic stress loading. We found the expression of the general chemical potential, which was often used in previous is not rigorous in logic.

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