CALPHAD type alloy thermodynamic methods originated a burst in capability of theoretical methods for phase transformations modeling. It is nowadays a wellestablished approach providing the Gibbs energies for alloy thermodynamics as well as the kinetic coefficients, e.g. atomic mobilities, in terms of database entries. The influence of mechanical properties on mechanical load, however, is modeled only through the hydrostatic pressure in current CALPHAD model approaches. In order to strengthen the modeling capabilities and descriptive power of CALPHAD type methods we present a theoretical model for alloys thermodynamics which incorporates crystal lattice symmetry and full set of elastic properties. The model has the form of a generalized Gibbs energy and takes into account cross-coupling between mechanical and chemical degrees of freedom. The proposed model allows describing phase equilibria in solid multi-phase systems taking into account the effect of internal and external stresses provided e.g. by phase-field simulations including micro-elasticity.