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Nota di contenuto	Chemical Thermodynamics of Materials; Contents; Preface; 1 Thermodynamic foundations; 1.1 Basic concepts; Thermodynamic systems; Thermodynamic variables; Thermodynamic processes and equilibrium; 1.2 The first law of thermodynamics; Conservation of energy; Heat capacity and definition of enthalpy; Reference and standard states; Enthalpy of physical transformations and chemical reactions; 1.3 The second and third laws of thermodynamics; The second law and the definition of entropy; Reversible and non-reversible processes Conditions for equilibrium and the definition of Helmholtz and Gibbs energiesMaximum work and maximum non-expansion work; The variation of entropy with temperature; The third law of thermodynamics; The Maxwell relations; Properties of the Gibbs energy; 1.4 Open systems; Definition of the chemical potential; Conditions for equilibrium in a heterogeneous system; Partial molar properties; The Gibbs-Duhem equation; References; Further reading; 2 Single-component systems; 2.1 Phases, phase transitions and phase diagrams; Phases and phase transitions; Slopes of the phase boundaries

Phase diagrams and Gibbs phase ruleField-induced phase transitions; 2.2 The gas phase; Ideal gases; Real gases and the definition of fugacity; Equations of state of real gases; 2.3 Condensed phases; Variation of the standard chemical potential with temperature; Representation of transitions; Equations of state; References; Further reading; 3 Solution thermodynamics; 3.1 Fundamental definitions; Measures of composition; Mixtures of gases; Solid and liquid solutions - the definition of chemical activity; 3.2 Thermodynamics of solutions; Definition of mixing properties; Ideal solutions
Excess functions and deviation from ideality3.3 Standard states; Henry's and Raoult's laws; Raoultian and Henrian standard states; 3.4 Analytical solution models; Dilute solutions; Solution models; Derivation of partial molar properties; 3.5 Integration of the Gibbs-Duhem equation; References; Further reading; 4 Phase diagrams; 4.1 Binary phase diagrams from thermodynamics; Gibbs phase rule; Conditions for equilibrium; Ideal and nearly ideal binary systems; Simple eutectic systems; Regular solution modelling; Invariant phase equilibria; Formation of intermediate phases
Melting temperature: depression or elevation?Minimization of Gibbs energy and heterogeneous phase equilibria; 4.2 Multi-component systems; Ternary phase diagrams; Quaternary systems; Ternary reciprocal systems; 4.3 Predominance diagrams; References; Further reading; 5 Phase stability; 5.1 Supercooling of liquids - superheating of crystals; 5.2 Fluctuations and instability; The driving force for chemical reactions: definition of affinity; Stability with regard to infinitesimal fluctuations; Compositional fluctuations and instability; The van der Waals theory of liquid-gas transitions
Pressure-induced amorphization and mechanical instability

Sommario/riassunto

A comprehensive introduction, examining both macroscopic and microscopic aspects of the subject, the book applies the theory of thermodynamics to a broad range of materials; from metals, ceramics and other inorganic materials to geological materials. Focusing on materials rather than the underlying mathematical concepts of the subject, this book will be ideal for the non-specialist requiring an introduction to the energetics and stability of materials. Macroscopic thermodynamic properties are linked to the underlying miscroscopic nature of the materials and trends in important properties are