Introduction To Phase Equilibria In Ceramics

Phase Equilibria in Chemical EngineeringPhase EquilibriaIntroduction to Phase Equilibria in Ceramic SystemsPhase Equilibria, Phase Diagrams and Phase TransformationsPhase Diagrams and Heterogeneous EquilibriaPhase Equilibria in Multicomponent SystemsPhase Equilibria in MaterialsThermodynamics of Phase Equilibria in Food EngineeringPhase Equilibria in Ionic Liquid Facilitated Liquid-Liquid ExtractionsPhase Equilibrium in MixturesIntroduction to Phase Equilibria in CeramicsPhase Equilibria in a System of 'breathing' MoleculesMolecular Thermodynamics of Fluid-Phase EquilibriaCritical Lines and Phase Equilibria in Binary MixturesPhase Equilibria in Natural Basic Liquids and the Evolution of Layered Mafic IntrusionsIntroduction to Phase Equilibria in Ceramic SystemsPhase Equilibria in the System CaCO3 - MgCO3 - FeCO3Phase Equilibria in the System SiO[subscript 2]-ZnOPhase Equilibria in Binary HalidesTernary Phase Equilibria in Transition Metal-boron-carbon-silicon Systems Stanley M. Walas Arnold Reisman Hummel Mats Hillert Bruno Predel Lev Samo□lovich Palatnik Camila Gambini Pereira Anand Bharti M. B. King Clifton G. Bergeron John M. Prausnitz Peter Henry Van Konynenburg Donald A. Snyder Floyd A. Hummel Lawrence Michael Anovitz Elmer Newman Bunting V.I. Posypaiko E. Rudy

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phase equilibria in chemical engineering is devoted to the thermodynamic basis and practical aspects of the calculation of equilibrium conditions of multiple phases that are pertinent to chemical engineering processes efforts have been made throughout the book to provide guidance to adequate theory and practice the book begins with a long chapter on equations of state since it is intimately bound up with the development of thermodynamics following material on basic thermodynamics and nonidealities in terms of fugacities and activities individual chapters are devoted to equilibria primarily between pairs of phases a few topics that do not fit into these categories and for which the state of the art is not yet developed quantitatively have been relegated to a separate chapter the chapter on chemical equilibria is pertinent since many processes involve simultaneous chemical and phase equilibria also included are chapters on the evaluation of enthalpy and entropy changes of nonideal substances and mixtures and on experimental methods this book is intended as a reference and self study as well as a textbook either for full courses in phase equilibria or as a supplement to related courses in the chemical engineering curriculum practicing engineers concerned with separation technology and process design also may find the book useful

phase equilibria basic principles applications experimental techniques presents an analytical treatment in

the study of the theories and principles of phase equilibria the book is organized to afford a deep and thorough understanding of such subjects as the method of species model systems condensed phase vapor phase equilibria and vapor transport reactions zone refining techniques and nonstoichiometry physicists physical chemists engineers and materials scientists will find the book a good reference material

written by a leading practitioner and teacher in the field of ceramic science and engineering this outstanding text provides advanced undergraduate and graduate level students with a comprehensive up to date introduction to phase equilibria in ceramic systems building upon a concise definition of the phase rule the book logically proceeds from one and two component systems through increasingly complex systems enabling students to utilize the phase rule in real applications unique because of its emphasis on phase diagrams timely because of the rising importance of ceramic applications practical because of its pedagogical approach introduction to phase equilibria in ceramic systems offers end of chapter review problems extensive reading lists a solid thermodynamic foundation and clear perspectives on the special properties of ceramics as compared to metals this authoritative volume fills a broad gap in the literature helping undergraduate and graduate level students of ceramic engineering and materials science to approach this demanding subject in a rational confident fashion in addition introduction to phase equilibria in ceramic systems serves as a valuable supplement to undergraduate level metallurgy programs

advanced undergraduate graduate level textbook which treats the theoretical basis of chemical equilibria and chemical changes

since j w gibbs in 1878 succeeded comprehensively in establishing the basic principles for an understanding of equilibria in heterogeneous systems numer ous books concerning constitution diagrams have been written some of them providing a formal treatment of phase equilibria down to the small detail the purpose of the present book is to provide an introduction to the practical ap plications of phase

diagrams in the first instance it is intended for students of chemistry metallurgy mineralogy and materials science but also for engineers and students of science and engineering disciplines concerned with materials to facilitate the start of an involvement with heterogeneous equilibria reactions and dynamic equilibria will be treated first since these are familiar to chemists and metallurgists of course a description of phase equilibria is not possible without a mini mum of formalism the formalistic description however will be made lighter by clear explanations of experimental methods used to determine the constitu tion of a system by application examples as well as by discussing realistic cas es from chemistry metallurgy materials science and mineralogy by this the ne cessity of the knowledge of phase diagrams can be shown on the other hand a practical exercise is possible

thermodynamics of phase equilibria in food engineering is the definitive book on thermodynamics of equilibrium applied to food engineering food is a complex matrix consisting of different groups of compounds divided into macronutrients lipids carbohydrates and proteins and micronutrients vitamins minerals and phytochemicals the quality characteristics of food products associated with the sensorial physical and microbiological attributes are directly related to the thermodynamic properties of specific compounds and complexes that are formed during processing or by the action of diverse interventions such as the environment biochemical reactions and others in addition in obtaining bioactive substances using separation processes the knowledge of phase equilibria of food systems is essential to provide an efficient separation with a low cost in the process and high selectivity in the recovery of the desired component this book combines theory and application of phase equilibria data of systems containing food compounds to help food engineers and researchers to solve complex problems found in food processing it provides support to researchers from academia and industry to better understand the behavior of food materials in the face of processing effects and to develop ways to improve the quality of the food products presents the fundamentals of phase equilibria in the food industry describes both classic and advanced

models including cubic equations of state and activity coefficient encompasses distillation solid liquid extraction liquid liquid extraction adsorption crystallization and supercritical fluid extraction explores equilibrium in advanced systems including colloidal electrolyte and protein systems

this book provides a comprehensive overview of ionic liquid based separation techniques the glimpse of thermodynamic predictive models along with global optimization techniques will help readers understand the separation techniques at molecular and macroscopic levels experimental and characterization techniques are coupled with model based predictions so as to provide multicomponent data for the scientific community the models will focus more on the a priori based predictions which gives higher emphasis on hydrogen bonded systems particle swarm optimization pso technique will also eventually help the readers to apply optimization technique to an extraction process the overriding goal of this work is to provide pathways for leading engineers and researchers toward a clear understanding and firm grasp of the phase equilibria of ionic liquid systems

phase equilibrium in mixtures deals with phase equilibrium and the methods of correlating checking and predicting phase data topics covered range from latent heat and vapor pressure to dilute solutions ideal and near ideal solutions and consistency tests molecular considerations and their use for the prediction and correlation of data are also discussed comprised of nine chapters this volume begins with an introduction to the role of thermodynamics and the criteria for equilibrium between phases along with fugacity and the thermodynamic functions of mixing the discussion then turns to some of the phase phenomena which may be encountered in chemical engineering practice methods of correlating and extending vapor pressure data and practical techniques for calculating latent heats from these data the behavior of dilute solutions both at low and high pressures for reacting and non reacting systems and the behavior of ideal and near ideal solutions the remaining chapters explore non ideal solutions at normal pressures practical methods for testing the thermodynamic consistency of phase data and the extent to which the broad aspects of phase

behavior may be interpreted in the light of simple molecular considerations this book is intended primarily for graduate chemical engineers but should also be of interest to those graduates in physics or chemistry who need to use phase equilibrium data

it is now well known that details in the intermolecular potential can significantly affect the qualitative features of a phase diagram where temperature is plotted against density for the coexistence curves among fluid and solid phases while previous calculations of phase diagrams have assumed a time invariant potential function this report concerns the phase diagram for breathing molecules i e molecules whose strength of intermolecular attraction fluctuates in time such fluctuations can occur in biomacromolecules where an active site can switch between on and off positions phase equilibrium calculations were performed for molecules that have a periodic breathing attractive force in addition to the conventional intermolecular forces the phase diagram for such molecules is as expected when the breathing properties are independent of density however when more realistically the breathing properties are density dependent the phase diagram exhibits dramatic changes these calculations may be useful for interpreting experimental data for protein precipitation for plaque formation in blood vessels and for scaffold supported tissue formation

the classic guide to mixtures completely updated with new models theories examples and data efficient separation operations and many other chemical processes depend upon a thorough understanding of the properties of gaseous and liquid mixtures molecular thermodynamics of fluid phase equilibria third edition is a systematic practical guide to interpreting correlating and predicting thermodynamic properties used in mixture related phase equilibrium calculations completely updated this edition reflects the growing maturity of techniques grounded in applied statistical thermodynamics and molecular simulation while relying on classical thermodynamics molecular physics and physical chemistry wherever these fields offer superior solutions detailed new coverage includes techniques for improving separation processes and

making them more environmentally friendly theoretical concepts enabling the description and interpretation of solution properties new models notably the lattice fluid and statistical associated fluid theories polymer solutions including gas polymer equilibria polymer blends membranes and gels electrolyte solutions including semi empirical models for solutions containing salts or volatile electrolytes coverage also includes fundamentals of classical thermodynamics of phase equilibria thermodynamic properties from volumetric data intermolecular forces fugacities in gas and liquid mixtures solubilities of gases and solids in liquids high pressure phase equilibria virial coefficients for quantum gases and much more throughout molecular thermodynamics of fluid phase equilibria strikes a perfect balance between empirical techniques and theory and is replete with useful examples and experimental data more than ever it is the essential resource for engineers chemists and other professionals working with mixtures and related processes

molten salts have been used for many years in a large number of industrial applications and interest in them has increased mark edly in the present century there is a vast amount of experi mental data published on molten salt systems and much of this is due to russian workers in 1961 the russian academy of sciences published a manual dealing with work in the period 1886 1955 these were updated in 1979 with the publication of a 3 volume collection of binary phase diagrams the present volume is a translation of the russian books but is restricted to the systems involving halides in order to keep the length of the book within bounds the data have been recast the russian work treats each system in detail giving data methods of study references and figures where available all together in this translation all the information is given but to keep the length down the methods have been classified the references collected at the end of the volume and the data given in tabular form all the figures for halide systems in the russian volume are included in the tables concentrations are given in mole percent in some cases these have been converted from weight per cent in the original russian where the russian work was in tabular form these have been

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Introduction

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