What Is Supercooling In Chemistry

Chemistry in the Service of Man
Mass, Heat Transfers and Stability
Liquid Glass Transition
The Freezing of Supercooled Water
Structural Glasses and Supercooled Liquids
Methods for Phase Diagram Determination
Chemical Demonstrations
Chemical Instabilities
The Journal of Industrial and Engineering Chemistry
Supercooling, Crystallization and Melting within Emulsions and Divided Systems
Physics of Liquid Matter
Metastable Liquids
Dynamical Heterogeneities in Glasses, Colloids, and Granular Media
Fast Scanning Calorimetry
Edible Oil Structuring
The Handbook of Continuous Crystallization
Supercooling and Freezing of HNO3/H2O Aerosols
The Journal of Physical Chemistry
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Handbook of Thermal Analysis and Calorimetry
Physics and Chemistry of Te and HgTe-based Ternary Semiconductor Melts
Journal of the American Chemical Society
Supercooling
Chemical Thermodynamics: Advanced Applications
Journal of the Chemical Society

ANDREWS ASHTYN

Chemistry in the Service of Man Elsevier
This book offers a didactic and a self-contained treatment of the physics of liquid and flowing matter with a statistical mechanics approach. Experimental and theoretical methods that were developed to study fluids are now frequently applied to a number of more complex systems generically referred to as soft matter. As for simple liquids, also for complex fluids it is important to understand how their macroscopic behavior is determined by the interactions between the component units. Moreover, in recent years new and relevant insights have emerged from the study of anomalous phases and metastable states of matter. In addition to the traditional topics concerning fluids in normal conditions, the authors of this book discuss recent developments in the field of disordered systems in condensed and soft matter. In particular they emphasize computer simulation techniques that are used in the study of soft matter and the theories and study of slow glassy dynamics. For these reasons the book includes a specific chapter about metastability, supercooled liquids and glass transition. The book is written for graduate students and active researchers in the field.

Mass, Heat Transfers and Stability Springer Nature
Phase diagrams are "maps" materials scientists often use to design new materials. They define what compounds and solutions are formed and their respective compositions and amounts when several elements are mixed together under a certain temperature and pressure. This monograph is the most comprehensive reference book on experimental methods for phase diagram determination. It covers a wide range of methods that have been used to determine phase diagrams of metals, ceramics, slags, and hydrides. * Extensive discussion on methodologies of experimental measurements and data assessments * Written by experts around the world, covering both traditional and combinatorial methodologies * A must-read for experimental measurements of phase diagrams

Liquid Glass Transition John Wiley & Sons
A classical metastable state possesses a local free energy minimum at infinite sizes, but not a global one. This concept is phase size independent. We have studied a number of experimental results and proposed a new concept that there exists a wide range of metastable states in polymers on different length scales where their metastability is critically determined by the phase size and dimensionality. Metastable states are also observed in phase transformations that are kinetically impeded on the pathway to thermodynamic equilibrium. This was illustrated in structural and morphological investigations of crystallization and mesophase transitions, liquid-liquid phase separation, vitrification and gel formation, as well as combinations of these transformation processes. The phase behaviours in polymers are thus dominated by interlinks of metastable states on different length scales. This concept successfully explains many experimental observations and provides a new way to connect different aspects of polymer physics. * Written by a

leading scholar and industry expert * Presents new and cutting edge material encouraging innovation and future research * Connects hot topics and leading research in one concise volume
John Wiley & Sons
Most of the solid materials we use in everyday life, from plastics to cosmetic gels exist under a non-crystalline, amorphous form: they are glasses. Yet, we are still seeking a fundamental explanation as to what glasses really are and to why they form. In this book, we survey the most recent theoretical and experimental research dealing with glassy physics, from molecular to colloidal glasses and granular media. Leading experts in this field present broad and original perspectives on one of the deepest mysteries of condensed matter physics, with an emphasis on the key role played by heterogeneities in the dynamics of glassiness.
The Freezing of Supercooled Water
Springer Science & Business Media
With contributions from 24 global experts in diverse fields, and edited by world-recognized leaders in physical chemistry, chemical physics and biophysics, Structural Glasses and Supercooled Liquids: Theory, Experiment, and Applications presents a modern, complete survey of glassy phenomena in many systems based on firmly established characteristics of the underlying molecular motions as deduced by first principle theoretical calculations, or with direct/single-molecule experimental techniques. A well-rounded view of a variety of disordered systems where cooperative phenomena, which are epitomized by supercooled liquids, take place is provided. These systems include structural glasses and supercooled liquids, polymers, complex liquids, protein conformational dynamics, and strongly interacting electron systems with quenched/self-generated disorder. Detailed calculations and reasoned arguments closely corresponding with experimental data are included, making the book accessible to an educated non-expert reader.
Structural Glasses and Supercooled Liquids Elsevier
In the past decades, the scan rate range of calorimeters has been extended tremendously at the high end, from approximately 10 up to 10 000 000 °C/s and more. The combination of various calorimeters and the newly-developed Fast Scanning Calorimeters (FSC) now span 11 orders of magnitude, by which many processes can be mimicked according to the time scale(s) of chemical and physical transitions occurring during cooling, heating and isothermal stays in case heat is exchanged. This not only opens new areas of research on polymers, metals, pharmaceuticals and all kinds of substances with respect to glass transition, crystallization and melting phenomena, it also enables in-depth study of metastability and reorganization of samples on an 1 to 1000 ng scale. In addition, FSC will become a crucial tool for understanding and optimization of processing methods at high speeds like injection molding. The book resembles the state-of-the art in Thermal Analysis & Calorimetry and is an excellent starting point for both experts and newcomers in the field.
Methods for Phase Diagram Determination OUP Oxford
Describes and gives instructions for lecture demonstrations covering acids and bases and liquids, solutions, and colloids.
Chemical Demonstrations

ScholarlyEditions
Green chemistry involves designing novel ways to create and synthesize products and implement processes that will eliminate or greatly reduce negative environmental impacts. The Green Chemistry Laboratory Manual for General Chemistry provides educational laboratory materials that challenge students with the customary topics found in a general chemistry laboratory manual, while encouraging them to investigate the practice of green chemistry. Following a consistent format, each lab experiment begins with objectives and prelab questions highlighting important issues that must be understood prior to getting started. This is followed by detailed step-by-step procedures for performing the experiments. Students report specific results in sections designated for data, observations, and calculations. Once each experiment is completed, analysis questions test students' comprehension of the results. Additional questions encourage inquiry-based investigations and further research about how green chemistry principles compare with traditional, more hazardous experimental methods. By placing the learned concepts within the larger context of green chemistry principles, the lab manual enables students to see how these principles can be applied to real-world issues. Performing laboratory exercises through green experiments results in a safer learning environment, limits the quantity of hazardous waste generated, and reduces the cost for chemicals and waste disposal. Students using this manual will gain a greater appreciation for green chemistry principles and the possibilities for future use in their chosen careers.
Chemical Instabilities Princeton University Press
Emulsions (simple, mixed or multiple) are essentially pure substances, aqueous or organic binary solutions. The have a wide range of uses, including industrial cooling and heat transfer processes. This monograph gives a brief overview of supercooling, crystallization and melting processes within emulsions. Differential scanning calorimetrey (DSC) coupled with RX is the main technique used to demonstrate these processes. Temperature readings in this work have been defined taking into account known nucleation laws. These results have been used to show mass transfers occurring within mixed emulsions (solid ripening) or multiple emulsions (composition ripening), gas hydrate formation due to a chemical reaction between water and a diffuse specific compound, these phenomena being described by diffusive models. Other aspects of heat transfer process covered in this book include the latent energy released at crystallizations or absorbed at the melting (which alters the temperature field through emulsions), the kinetics of phase transformations and self-regulation of temperature in nodules containing phase changing materials. This monograph is intended for advanced chemistry graduates as well as industrial and chemical engineers working with cooling and heat transfer systems.
The Journal of Industrial and Engineering Chemistry BoD – Books on Demand
Driven both by real industrial needs and curiosity for fundamental research, edible oil structuring has emerged as a subject of growing interest with applications in real food systems. With contributions from leading research groups around the world, this book provides a comprehensive and concise overview of the field with special

emphasis on the updates from the last 5 years. New insights into the mechanism of gelation in mono- and multicomponent gels are discussed for several categories of previously known structuring agents along with the potential food applications of some of these systems. In addition, use of alternative methods to explore structuring properties of hydrophilic biopolymers are presented with illustrative examples. Some new concepts such as bio-based synthesis of supergelators, foamed oleogels and use of innovative dispersion techniques give a broader picture of the current research in edible oil structuring. This book will be of interest to students, academics and scientists involved in the research of edible oil structuring. It will be an important reference as it provides current information on the state-of-the-art of the field.

Supercooling, Crystallization and Melting within Emulsions and Divided Systems Bentham Science Publishers

This Volume, the last of the series, is devoted to water in its metastable forms, especially at sub-zero temperatures. The past few years have wit nessed an increasing interest in supercooled water and amorphous ice. If the properties of liquid water in the normal temperature range are already eccentric, then they become exceedingly so below the normal freezing point, in the metastable temperature range. Water can be supercooled to -39°C without too much effort, and most of its physical properties show a re markable temperature dependence under these conditions. Although ade quate explanations are still lacking, the time has come to review available knowledge. The study of amorphous ice, that is, the solid formed when water vapor is condensed on a very cold surface, is of longer standing. It has achieved renewed interest because it may serve as a model for the liquid state. There is currently a debate whether or not a close structural relation ship exists between amorphous ice and supercooled water. The nucleation and growth of ice in supercooled water and aqueous solutions is also still one of those grey areas of research, although these topics have received considerable attention from chemists and physicists over the past two decades. Even now, the relationships between degree of supercooling, nucleation kinetics, crystal growth kinetics, cooling rate and solute concentration are somewhat obscure. Nevertheless, at the empirical level much progress has been made, because these topics are of considerable importance to biologists, technologists, atmospheric physicists and gla ciologists.

Physics of Liquid Matter Cambridge University Press

Supercooling, Crystallization and Melting within Emulsions and Divided SystemsBentham Science Publishers

Metastable Liquids Springer Science & Business Media

Continuous crystallization is an area of intense research, with particular respect to the pharmaceutical industry and fine chemicals. Improvements in continuous crystallization technologies offer chemical industries significant financial gains, through reduced expenditure and operational costs, and consistent product quality. Written by well-known leaders in the field, The Handbook of Continuous Crystallization presents fundamental and applied knowledge, with attention paid to application and scaling up, and the burgeoning area of process intensification. Beginning with

concepts around crystallization techniques and control strategies, the reader will learn about experimental methods and computational tools. Case studies spanning fine and bulk chemicals, the pharmaceutical industry, and employing new mathematical tools, put theory into context. With regulatory considerations also covered, this book is a must-have guide for the field.

Dynamical Heterogeneities in Glasses, Colloids, and Granular Media Elsevier

The freezing kinetics of binary nitric acid/water aerosols is of fundamental importance to the modelling of polar stratospheric clouds and the role they in ozone depletion over the Arctic/Antarctic regions. Cirrus clouds are also often composed of nitric acid solutions, hence an understanding of freezing process in these aerosols also aids in modelling the earth®s radiation budget and global warming. This thesis explores the kinetic phase diagram of nitric acid/water aerosols with sizes ranging between 0.2 and 1.5 mm in radius and concentrations ranging between pure water and 0.45 mole fraction HNO3. Although the kinetic phase diagram has now been studied between 0.46 mole fraction HNO3 and pure water, more data is needed in the region between 0.18 and 0.25 mole fraction HNO3 to confirm the results reported. The project described in this thesis are a continuation of a project begun by Allan Bertram. The measurements involving aerosols with compositions greater than 0.25 mole fraction HNO3 were carried out as part of Allan Bertram®s Ph. D. thesis (see ref. 20) These data were later examined using a more comprehensive data analysis method (as presented in this thesis) in an effort to obtain a more complete understanding of this system.

Fast Scanning Calorimetry Royal Society of Chemistry

Metastable Liquids provides a comprehensive treatment of the properties of liquids under conditions where the stable state is a vapor, a solid, or a liquid mixture of different composition. It examines the fundamental principles that govern the equilibrium properties, stability, relaxation mechanisms, and relaxation rates of metastable liquids. Building on the interplay of kinetics and thermodynamics that determines the thermophysical properties and structural relaxation of metastable liquids, it offers an in-depth treatment of thermodynamic stability theory, the statistical mechanics of metastability, nucleation, spinodal decomposition, supercooled liquids, and the glass transition. Both traditional topics--such as stability theory--and modern developments--including modern theories of nucleation and the properties of supercooled and glassy water--are treated in detail. An introductory chapter illustrates, with numerous examples, the importance and ubiquity of metastable liquids. Examples include the ascent of sap in plants, the strategies adopted by many living organisms to survive prolonged exposure to sub-freezing conditions, the behavior of proteins at low temperatures, metastability in mineral inclusions, ozone depletion, the preservation and storage of labile biochemicals, and the prevention of natural gas clathrate hydrate formation. All mathematical symbols are defined in the text and key equations are clearly explained. More complex mathematical explanations are available in the appendixes.

Edible Oil Structuring John Wiley & Sons

On March 14-18, 1983 a workshop on

"Chemical Instabilities: Applications in Chemistry, Engineering, Geology, and Materials Science" was held in Austin, Texas, U.S.A. It was organized jointly by the University of Texas at Austin and the Universite Libre de Bruxelles and sponsored qy NATO, NSF, the University of Texas at Austin, the International Solvay Institutes and the Ex xon Corporation. The present Volume includes most of the material of the in vited lectures delivered in the workshop as well as material from some posters, whose content was directly related to the themes of the invited lectures. In ,recent years, problems related to the stability and the nonlinear dynamics of nonequilibrium systems invaded a great num ber of fields ranging from abstract mathematics to biology. One of the most striking aspects of this development is that subjects reputed to be "classical" and "well-established" like chemistry, turned out to give rise to a rich variety of phenomena leading to multiple steady states and hysteresis, oscillatory behavior in time, spatial patterns, or propagating wave fronts. The primary objective of the workshop was to bring together researchers actively engaged in fields in which instabilities and nonlinear phenomena similar to those observed in chemistry are of current and primary concern : chemical engineering (especially surface catalysis), combustion (dynamics of ignition, flame sta bili t;y), interfaces (emulsification, dendritic growth), geology (regularly repeated patterns of mineralization 1n a variety of spabe scales), and materials science (dynamical solidification, behavior of matter under irradiation).

The Handbook of Continuous Crystallization Elsevier

This book is an excellent companion to Chemical Thermodynamics: Principles and Applications. Together they make a complete reference set for the practicing scientist. This volume extends the range of topics and applications to ones that are not usually covered in a beginning thermodynamics text. In a sense, the book covers a "middle ground" between the basic principles developed in a beginning thermodynamics textbook, and the very specialized applications that are a part of an ongoing research project. As such, it could prove invaluable to the practicing scientist who needs to apply thermodynamic relationships to aid in the understanding of the chemical process under consideration. The writing style in this volume remains informal, but more technical than in Principles and Applications. It starts with Chapter 11, which summarizes the thermodynamic relationships developed in this earlier volume. For those who want or need more detail, references are given to the sections in Principles and Applications where one could go to learn more about the development, limitations, and conditions where these equations apply. This is the only place where Advanced Applications ties back to the previous volume. Chapter 11 can serve as a review of the fundamental thermodynamic equations that are necessary for the more sophisticated applications described in the remainder of this book. This may be all that is necessary for the practicing scientist who has been away from the field for some time and needs some review. The remainder of this book applies thermodynamics to the description of a variety of problems. The topics covered are those that are probably of the most fundamental and broadest interest. Throughout the book, examples of "real" systems are used as much as possible.

This is in contrast to many books where "generic" examples are used almost exclusively. A complete set of references to all sources of data and to supplementary reading sources is included. Problems are given at the end of each chapter. This makes the book ideally suited for use as a textbook in an advanced topics course in chemical thermodynamics. An excellent review of thermodynamic principles and mathematical relationships along with references to the relevant sections in Principles and Applications where these equations are developed Applications of thermodynamics in a wide variety of chemical processes, including phase equilibria, chemical equilibrium, properties of mixtures, and surface chemistry Case-study approach to demonstrate the application of thermodynamics to biochemical, geochemical, and industrial processes Applications at the "cutting edge" of thermodynamics Examples and problems to assist in learning Includes a complete set of references to all literature sources

Supercooling and Freezing of HNO3/H2O Aerosols Univ of Wisconsin Press

Nucleation of Water: From Fundamental Science to Atmospheric and Additional Applications provides a comprehensive accounting of the current state-of-the-art regarding the nucleation of water. It covers vapor-liquid, liquid-vapor, liquid-ice and vapor-ice transitions and describes basic kinetic and thermodynamic concepts in a manner understandable to researchers working on specific applications. The main focus of the book lies in atmospheric phenomena, but it also describes engineering and biological applications. Bubble nucleation, although not of major atmospheric relevance, is included for completeness. This book presents a single, go-to resource that will help readers understand the breadth and depth of nucleation, both in theory and in real-world examples. Offers a single, comprehensive work on water nucleation, including cutting- edge research on ice, cloud and bubble nucleation Written primarily for atmospheric scientists, but it also presents the theories in such a way that researchers in other disciplines will find it useful Written by one of the world’s foremost experts on ice nucleation

The Journal of Physical Chemistry Elsevier

Includes section "New Books"

Green Chemistry Laboratory Manual for General Chemistry Springer Science & Business Media

Nanodroplets, the basis of complex and advanced nanostructures such as quantum rings, quantum dots and quantum dot clusters for future electronic and optoelectronic materials and devices, have attracted the interdisciplinary interest of chemists, physicists and engineers. This book combines experimental and theoretical analyses of nanosized droplets which reveal many attractive properties. Coverage includes nanodroplet synthesis, structure, unique behaviors and their nanofabrication, including chapters on focused ion beam, atomic force microscopy, molecular beam epitaxy and the "vapor-liquid- solid" route. Particular emphasis is given to the behavior of metallic nanodroplets, water nanodroplets and nanodroplets in polymer and metamaterial nanocomposites. The contributions of leading scientists and their research groups will provide readers with deeper insight into the chemical and physical

mechanisms, properties, and potential applications of various nanodroplets.

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