

Solid State

Types of solids

Crystalline solid	Amorphous solids
- Definite & regular arrangement - True solids - Long ordered arrangement of particles - These are anisotropic - Sharp M.P - Clean cleavage cut - Ex - NaCl, KCl	- Doesn't have regular arrange - Pseudo solids or super cooled liq - Short ordered arrangement - These are isotropic - Melt over certain range of temp - Irregular cleavage cut - Ex - glass, rubber

Isomorphism - Two or more substance having same crystal structure
 - same atomic ratio
 Ex NaF & MgO - 1:1
 NaNO₃ & CaCO₃ - 1:1:3

Polymorphism - A single substance that exists in two or more forms of crystalline structure
 Ex Calcite & aragonite are forms of calcium carbonate
 Ex - α-quartz, β-quartz & cristobalite - these forms of silica
 - Polymorphism occurring in elements are called allotropy
 Ex Carbon - diamond, graphite, fullerene.

Classification of crystalline solids

1) **Ionic** - Electrostatic force of attraction
 Ion - Ion force
 - Brittle, hard, high melting point
 - non conductors of electricity "when dissolved or melted in water."
 Ex - NaCl, KCl, MgCl₂

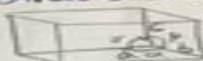
2) **Molecular** -
 - Dispersion / Dipole-Dipole / H-Bond
 - Soft, low melting point
 - non conductors & good insulators
 Ex H₂O, Br₂, CO₂, CH₄

3) **Covalent** -
 - Covalent Bond
 - Hard, high melting point, B.P
 - Most incompressible
 - Poor conductor
 Ex - C-diamond, SiO₂, BN, Carborandum

4) **Metallic** -
 - Metallic Bond
 - Variable hardness, M.P, conductivity
 - They are malleable, ductile & good conductors
 Ex - Na, Zn, Cu, Fe

Crystal Lattice - or space lattice - Lattice is a geometrical arrangement of points in 3D form such constituent particles that are attached to the lattice points are crystal lattice.

Unit Cell - The smallest repeating structural unit of a crystalline solid



→ of unit cell.

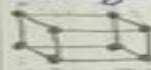
1) **Simple or primitive unit cell**
 - Particles are present at corners only

$$8 \times \frac{1}{8} = 1 \text{ atom}$$

2) **Face centered** - The particles are present at the corners & also at the center $8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 1 + 3 = 4 \text{ atoms}$

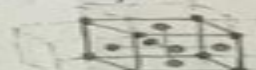
3) **Body centered** - The particles are present at the corners as well as at the centre of the unit cell
 $8 \times \frac{1}{8} + 1 = 1 + 1 = 2 \text{ atoms}$

Note -
 • An atom at the corner is shared by eight unit cell - $\frac{1}{8}$
 • An atom at the face is shared by two cell - $\frac{1}{2}$
 • An atom at the body centre of a unit cell belongs entirely to it - 1



$$8 \times \frac{1}{8} = 1$$

1 atom
SC - 1



$$8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 1 + 3 = 4 \text{ atoms}$$

1 + 3 = 4 atom
B FCC - 4



$$8 \times \frac{1}{8} + 1 = 1 + 1 = 2 \text{ atoms}$$

1 + 1 = 2 atom
BCC - 2

Solid State Chemistry Notes Hsc

Anthony R. West



Solid State Chemistry Notes Hsc:

Minerals at the Nanoscale F. Nieto, K.J.T. Livi, 2013-05-24 The editors have gathered in this book reviews of past and current studies of mineral groups that have played important roles in geology environmental science and health science The various chapters cover the application of TEM and related techniques to mineral groups in which TEM investigations have been extensive and crucial to the understanding of their mineralogy namely pyroboles serpentines clays micas and other metamorphic phyllosilicates oxides and oxyhydroxides sulfides and carbonates Some research fields for which TEM is particularly suitable and which have produced significant advances in particular are inclusions and traces extraterrestrial material deformation processes non stoichiometry and superstructures and biominerals Nowadays we are witnessing the push for the improvement of detectors for imaging direct detection of electrons and X rays silicon drift detectors and annular high solid angle of collection detectors the development of new support materials e.g graphene and liquid cells for TEMs Most of these new technologies have not yet been applied to mineralogical problems but we hope they will be in the near future

Processing and Properties of Advanced Ceramics and Composites IV J. P. Singh, Narottam P. Bansal, Takashi Goto, Jacques Lamon, Sung R. Choi, Morsi M. Mahmoud, Guido Link, 2012-09-28 With contributed papers from the 2011 Materials Science and Technology symposia this is a useful one stop resource for understanding the most important issues in the processing and properties of advanced ceramics and composites Logically organized and carefully selected the articles cover the themes of the symposia Innovative Processing and Synthesis of Ceramics Glasses and Composites Advances in Ceramic Matrix Composites Solution Based Processing of Materials and Microwave Processing of Materials A must for academics in mechanical and chemical engineering materials and or ceramics and chemistry

High Temperature Gas-Solid Reactions in Earth and Planetary Processes Penelope King, Bruce Fegley, Terry Seward, 2018-12-03 High temperature gas solid reactions are ubiquitous on planetary bodies distributing chemical elements over a range of geologic settings and temperatures This volume reviews the critical role gas solid reactions play in early solar system formation volcanism metamorphism and industrial processes The field evidence experimental and theoretical approaches for examining gas solid reaction are presented building on advances in fields outside of Earth Sciences Computational chemistry techniques are used to probe the nature of molecular clusters and solvation in volcanic vapors and mineral gas reaction mechanisms Specialised analytical methods for characterising solid reaction products are included since these reactions commonly form thin or dispersed films and metastable minerals Finally the volume contains rich field examples laboratory experiments and thermodynamic modelling and kinetics of gas solid reactions on Earth Venus and beyond

Principles of Solid State Chemistry Petr Petrovich Budnikov, Arkadii Mikhailovich Ginstling, 1968

Lecture Notes on Solid State Chemistry, 198?

Solid State Chemistry Lesley E. Smart, Elaine A. Moore, 2016-04-19 Building a foundation with a thorough description of crystalline structures Solid State Chemistry An Introduction Fourth Edition presents a wide range of the synthetic and

physical techniques used to prepare and characterize solids Going beyond basic science the book explains and analyzes modern techniques and areas of research The book covers A range of synthetic and physical techniques used to prepare and characterize solids Bonding superconductivity and electrochemical magnetic optical and conductive properties STEM ionic conductivity nanotubes and related structures such as graphene metal organic frameworks and FeAs superconductors Biological systems in synthesis solid state modeling and metamaterials This largely nonmathematical introduction to solid state chemistry includes basic crystallography and structure determination as well as practical examples of applications and modern developments to offer students the opportunity to apply their knowledge in real life situations and serve them well throughout their degree course New in the Fourth Edition Coverage of multiferroics graphene and iron based high temperature superconductors the techniques available with synchrotron radiation and metal organic frameworks MOFs More space devoted to electron microscopy and preparative methods New discussion of conducting polymers in the expanded section on carbon nanoscience

Fundamentals of Inorganic Chemistry Bruce E. Wilcox, 1997-07 **Resources in Education**, 1977 **Bulletin of the Chemical Society of Japan** Nihon Kagakkai, 1969 **General and Inorganic Chemistry** Philip John Durrant, 1939 Russian Journal of Physical Chemistry, 1985-09 *Solid-State Chemistry* Ashok Kumar Jha, 2023-08-04

Solid state reactions have been growing in importance in the preparation of solids crystal growth and single crystals of elements In this new volume the author discusses in depth recent advances in solid state chemistry the latest techniques of characterization of solids and several new dimensions of solid state problems Solid state reactions their kinetics phase transitions and magnetic properties are discussed in detail along with electrical properties semiconductors metals and insulators with examples and explanations Dielectric piezoelectric and ferroelectric properties of solids have been considered as well Different theories of catalysis and adsorption isotherms are covered and the author includes several experimental findings as well And of course preparation of new solids by taking advantage of recent experimental techniques have also been included in this volume This volume provides a complete description of solid state reactions electrical conductivity characterization of solids organic solids and intercalation between layers of solids The band theories of metals semiconductors and insulators are covered In characterization of solids TGA DTA DSC FTIR and PXRD techniques have been described Preparation and properties of organic solids are also explained Dielectric properties photovoltaic effects piezoelectricity ferroelectricity and antiferroelectricity have been dealt with giving relatable examples A number of excitation energy levels giving rise to luminescence and photoluminescence have been explained under the topic optical processes Diamagnetic paramagnetic and ferromagnetic behaviors of solids are also explained

Introduction to Solid State Chemistry James E. House, 2024-02-21 Introduction to Solid State Chemistry provides a strong background to the structures of solids and factors that determine this structure The content presented will also stress transformations of solids both in physical forms and chemical composition In so doing topics such as phase transitions sintering reactions of coordination

compounds photovoltaic compounds are described whilst kinetics and mechanisms of solid state reactions are covered in depth There are currently few books that deal with solid state chemistry where a considerable number instead deal with solid state physics and materials science engineering This book provides someone needing or wishing to learn about the chemistry of solids a comprehensive resource that describes structures of solids the behaviour of solids under applied stresses the types of reactions that solids undergo and the phenomenological aspects of reactions in solids Kinetics of reactions in solids is very seldom covered in current literature and an understanding of the mechanisms of reactions in solids is necessary for many applications James E House provides a balanced treatment of structure dynamics and behaviour of solids at a level commensurate with upper level undergraduates or beginning graduate students who wish to obtain an introduction and overview to solid state chemistry Provides a fundamental introduction and entry point to solid state chemistry acting as a useful prerequisite for further learning in the area Presents a balanced approach that not only emphasizes structures of solids but also provides information on reactions of solids and how they occur Gives much needed focus to the kinetics of reactions of solids and their mechanisms where existing literature covers little of this Explores crucial solid state chemistry topics such as solar energy conversion reactions of solid coordination compounds diffusion sintering and other transformations of solids Features accessible and well written examples and case studies featuring many new and bespoke supporting illustrations offering an excellent framework that will help students to understand reaction mechanisms

Principles of Solid State Chemistry P. P. Budnikov, 1948* *Solid State Chemistry and Its Applications* Anthony R. West, 1991-01-08 The first broad account offering a non mathematical unified treatment of solid state chemistry Describes synthetic methods X ray diffraction principles of inorganic crystal structures crystal chemistry and bonding in solids phase diagrams of 1 2 and 3 component systems the electrical magnetic and optical properties of solids three groups of industrially important inorganic solids glass cement and refractories and certain aspects of organic solid state chemistry including the organic metal of new materials **Solid State Chemistry and Physics** Paul F. Weller, 1973 Fourth International Symposium on Recycling of Metals and Engineered Materials Donald L. Stewart, Jr., James C. Daley, Robert L. Stephens, 2013-09-12 This proceedings collection continues the tradition established by earlier TMS Recycling Meetings in this series by presenting fundamental and practical aspects of recycling metals and engineered materials **Principles of Solid State Chemistry** P. P. Budnikov, A. M. Ginstling, 1962 *Comprehensive Dissertation Index*, 1984 **Treatise on Solid State Chemistry** N. Hannay, 2012-12-06 The last quarter century has been marked by the extremely rapid growth of the solid state sciences They include what is now the largest subfield of physics and the materials engineering sciences have likewise flourished And playing an active role throughout this vast area of science and engineering have been very large numbers of chemists Yet even though the role of chemistry in the solid state sciences has been a vital one and the solid state sciences have in turn made enormous contributions to chemical thought solid state chemistry has not been recognized by the

general body of chemists as a major subfield of chemistry Solid state chemistry is not even well defined as to content Some for example would have it include only the quantum chemistry of solids and would reject thermodynamics and phase equilibria this is nonsense Solid state chemistry has many facets and one of the purposes of this Treatise is to help define the field Perhaps the most general characteristic of solid state chemistry and one which helps differentiate it from solid state physics is its focus on the chemical composition and atomic configuration of real solids and on the relationship of composition and structure to the chemical and physical properties of the solid Real solids are usually extremely complex and exhibit almost infinite variety in their compositional and structural features

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