Compositional Evolution Of Structural Phase Transitions In Sodium Niobates

#sodium niobates #phase transitions #structural evolution #perovskite materials #ferroelectric properties

This research delves into the fascinating compositional evolution of structural phase transitions observed in sodium niobates. It examines how subtle changes in material composition drive significant alterations in their crystal structure and fundamental properties, providing critical insights for understanding these important perovskite materials and their potential applications, particularly regarding their ferroelectric behavior.

Compositional Evolution Of Structural Phase Transitions In Sodium Niobates

CaO pressure induced structural phase transition from B1 to B33 to B2 - CaO pressure induced structural phase transition from B1 to B33 to B2 by Branicio Research Lab 261 views 6 years ago 25 seconds - From work published on Europhysics Letters, 76, 836 (2006) Link to paper: http://dx.doi.org/10.1209/epl/i2006-10347-6.
Phase transitions and Emergence of structural complexity - Phase transitions and Emergence of structural complexity by ESRFsynchrotron 647 views Streamed 3 years ago 55 minutes - Consortium Partners: Aalto University European Organization for Nuclear Research (CERN) European Industrial Research ...
Intro
Graphite to Diamond
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Classification of phase transitions
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Potential impact of ABS
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Diamond Anvil Cell
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Glass Transition
Firstorder liquid transitions
Liquid stability field
Liquid liquid critical point
System open questions

Polymerization
Conclusion
Questions
Closing
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Types of Change
Phase Transition
Punctuated Equilibrium
Summary
Phase transitions - 9 - Phase transitions - 9 by bhadeshia123 1,355 views 1 year ago 38 minutes - Alloys of iron are by far the most successful **structural**, material; there are simply no challengers for the vast majority of applications.
Nanostructures by phase transformation - Nanostructures by phase transformation by bhadeshia123 1,427 views 11 years ago 1 minute, 56 seconds - Setting the rules for the creation of nanostructures in metals. http://www.msm.cam.ac.uk/**phase**,-trans/2005/bulk.html.
Phase transitions - 2 - Phase transitions - 2 by bhadeshia123 2,351 views 1 year ago 39 minutes - Pippard, in his wonderful book "Elements of Classical Thermodynamics", states that "the function of thermodynamics is to link ...
Variables of Interest
Internal Energy
Heat Capacity
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Differential Scanning Calorimeter
The Output of the Differential Scanning Calorimeter
Metallic Glass
High Entropy Alloys
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Low-dimensional descriptions
Setting
Examples of dynamics
Predictions for high-dimensional dynamics
Summary
Resource competition models - high-dim chaos
Relevant parameters
Detour: random interactions + coexistence
Phase transitions - 4 - Phase transitions - 4 by bhadeshia123 1,654 views 1 year ago 46 minutes - The idea of equilibrium has many connotations - for a pure substance, **phases**, in equilibrium have identical free energies.
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What do we need from phase diagrams?
"regular" solution
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Phase transitions - 1 - Phase transitions - 1 by bhadeshia123 3,757 views 1 year ago 1 hour, 4 minutes - To paraphrase Cottrell, "there are three main frontiers of science today. First, the science of the very large, i.e., cosmology. Second ...
Liquid Crystal

Liquid Crystal Displays
Thermal Barrier Coating
Phase Transformations
Reconstructive Transformation
Atomic Force Microscope
Invariant Plane Strain
Example of Phase Transmission
X-Ray Diffraction
Grenoble Synchrotron
Calculate the D Spacing of a Crystal
How we Deduce Mantle Composition & Structure From Basalts- Igneous Petrology #9 | GEO GIRL - How we Deduce Mantle Composition & Structure From Basalts- Igneous Petrology #9 | GEO GIRL by GEO GIRL 7,769 views 2 years ago 20 minutes - This video covers the importance of basalt on Earth, the 2 main types of basalt (alkaline and tholeiitic basalts), how to read the ...
why is basalt important?
2 types of basalt
basalt tetrahedron
differences between alkali and tholeiitic basalt
nepheline quartz phase diagram
4 ways we determine mantle composition & structure
layers of Earth's interior
what induces partial melting of the mantle?
what composition results from mantle melting?
different or same source for alkalis & tholeiites?
4 types of magma generating environments
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The short answer
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And what about the giant component?
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Back to random graphs
and in high dimensions
A view of phase transition in G(np)
Phase transition in X (np) complexes
Phase transitions
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October 2017 ...
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compositional-evolution-sodium-niobates
structural-phase-transitions-nanomaterials
sodium-niobate-phase-diagrams
Sodium Niobate, Phase Transitions, Compositional Evolution, Structural Analysis, Niobate Materials
This study explores the compositional evolution of structural phase transitions in sodium niobates, focusing on how varying the composition influences the stability and behavior of different phases. Understanding these transitions is crucial for tailoring the material's properties for applications in piezoelectric devices, sensors, and other functional materials where phase stability is a critical factor.

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Mechanics of Materials
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Concrete Design
Geotechnical Engineering/Soil Mechanics
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Truss Calculation

Determine whether or not the Truss is Statically Determinant
Determine the External Forces of the Truss
Determine the Angles of the Truss
Determine the Internal Forces of the Truss
Trusses | Method of Sections | Problem 11 | Engineering Mechanics | 11.11 - Trusses | Method of Sections | Problem 11 | Engineering Mechanics | 11.11 by KSG Engineering 49,852 views 3 years ago 24 minutes
Introduction
Equations
Resolving
Solution
English - Truss Analysis Using Method of Joints Part 1 of 2 - English - Truss Analysis Using Method of Joints Part 1 of 2 by CTSCIVIL 816,736 views 14 years ago 9 minutes, 14 seconds - Analyzing a simple truss using the method of joints #**Engineering**, #civil_engineering #structuralengineering ...
start with finding the reactions of the supports
find the summation of the forces in the x
try to take the summation of the moments
start picking the joints
EXPLAINED !!!Analysis Of Trusses - Engineering Mechanics - Method Of Joints - EXPLAINED !!!Analysis Of Trusses - Engineering Mechanics - Method Of Joints by EzEd Channel 36,144 views 5 years ago 4 minutes, 18 seconds - This Video explains the Method Of Joints used to Analyze the forces acting on the Trusses. The two types of forces acting on a ...
Analysis of Trusses
Methods For Analyzing Trusses
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truss method of section spr18 - truss method of section spr18 by Randall Manteufel 99,882 views 6 years ago 14 minutes, 4 seconds - statics problem.
Method of Section
Freebody Diagram for the Section
The Method of Section
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Method of Sections
The Method of Sections on this Truss
Free Body Diagram of Half the Truss
The Moment Equation
Method of Non Concurrent Forces
Problem F3-6: structural analysis:trusses - Problem F3-6: structural analysis:trusses by Eng. Radfan Ojailah 3,957 views 7 years ago 10 minutes, 48 seconds - ... **structural analysis**,, ild in **structural analysis**, in hindi, **hibbeler structural analysis 8th edition**,, flexibility method **structural analysis-**, ...
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Intro
Determine the force in each member of the truss.
Determine the force in each member of the truss and state
The maximum allowable tensile force in the members
Calculating Reactions of a Frame - Structural Analysis - Calculating Reactions of a Frame - Structural Analysis by structurefree 411,606 views 11 years ago 19 minutes - Example problem calculating the reactions of a frame. This video illustrates how to check the determinacy of a frame with hinges ...
Trusses Method of Sections | Mechanics Statics | (Solved examples) - Trusses Method of Sections | Mechanics Statics | (Solved examples) by Question Solutions 169,920 views 3 years ago 11 minutes - Learn to solve for unknown forces in trusses using the method of sections. We go through multiple examples, step by step, using ...

Intro
The Howe truss is subjected to the loading shown.
Determine the force in members BE, EF, and CB
Determine the force in members DC, HC, and HI of the truss
Determine the force in members JI and DE of the K truss.
STRUCTURAL ANALYSIS - CANTILEVER METHOD SOLVED QUESTION -1 - STRUCTURAL ANALYSIS - CANTILEVER METHOD SOLVED QUESTION -1 by ACIVILENGINEER 393 views 1 year ago 20 minutes - ... **Structural Analysis 8th edition**, R.C.**Hibbeler**,. https://www.amazon.com/-**Structural**,-**Analysis**,-**8th**,-Russell-**Hibbeler**,/dp/013257053X ...
Truss analysis by method of joints: worked example #1 - Truss analysis by method of joints: worked example #1 by Engineer4Free 799,629 views 7 years ago 14 minutes, 53 seconds - This **engineering**, statics tutorial goes over a full example using the method of joints for truss **analysis**,. You first need to solve for ...
draw a freebody diagram of the entire structure
take a sum of moments
sum up to 200 using our symbol forces in the y direction
drawn all of the unknown forces
start with the sum of forces in the y-direction
take the sum of forces in the y in the x direction
switch the arrows
take the sum of forces in the y-direction
divide out the sine of 60 from both sides
let's do the sum of forces in the y-direction
start sum of forces in the x direction
update your diagrams
solved for all of the internal force
found all of the internal forces
check that our sum of forces in the y direction
sum of forces in the x direction
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Best New Home Building Products of 2024! International Builder Show Recap - Best New Home Building Products of 2024! International Builder Show Recap by Jordan Smith 5,024 views 3 days ago 10 minutes, 38 seconds - Welcome back, viewers! We had a great time at the 2024 **International**, Builders Show. Prepare to be amazed by groundbreaking ...
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HX50 Monthly Updated & AMA - 13 March 2024 - HX50 Monthly Updated & AMA - 13 March 2024 by Hill Helicopters 4,849 views 2 days ago 2 hours, 4 minutes - Tune in to the latest HX50 Monthly Update & AMA, broadcast live on March 13, 2024, from the Hill Development Centre.
Ruben & Mischa Intro
Jason Hill Intro
Company
Production Centre 1
GT50
Drivetrain
Digital Cockpit
Electrical Systems
Start of AMA Session
Update on production and fielding schedule?
Prototype rollout date?
Production timeline estimation?
Alternatives for HX50 wheel transport and shipping thoughts?
Software development, standards, and QA details?

Production Centre 1 location?
Avionics partner or in-house development?
Strategy to meet production capacity promises?
Contingency for GT50 engine delays?
Baggage door strut inclusion?
Blade tip geometry optimization for attack angle/stall?
Simulations performed and model accuracy vs. real tests?
Engine inlet barrier filter for dust/snow?
Incidental shock testing during component operation?
Timeline for 51% HX50 build participation?
GT50 testing with SAF from inception?
SAF vs. Bio-diesel differences?
Wheeled landing gear crash performance benefits?
Hot air re-injection post-combustion into airflow?
Dynamic gearbox mounting shocks status?
Additional staff requirements and recruitment for fit?
Strobe light option for front LED?
Ground lighting color change capability?
In-flight auxiliary battery charging?
Engine exhaust position relative to rear pylon?
Seat comfort testing in motor vehicle settings?
Gearbox cooling sufficiency with faired cowling?
Hub and cowling cooling solutions?
Use of sound designer for signature tone?
Is the STARFLEX main rotor hollow?
Strap-pack lifetime expectancy?
Consideration of 3D printing for annular combustor?
Clarification on 400 aircraft/year production timeline?
Microsoft Flight Simulator update?
Details on servo actuators?
Starter generator role in engine failure?
Helimove system for trailer mounting capability?
Industry reception of production and engineering?
Hill Cloud functionality and cockpit cloud independence?
External battery charging and climate control power port plans?
First flight test location?
Pilot and tech training plans?
Cargo hook option details?
PC1 location and HalfPenny Green airfield status?
HX50 flight and audio recording, blackbox inclusion?
Standard battery type for HX/HC?
Wheeled vs. skidded ground resonance risk?
Cabin door mechanism issue resolution?
Test-pilot role in owner-built HX50 first flights?
Manual FADEC control possibility?
Syndicated ownership build attendance requirement?
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LATICRETE Launches New Construction Solution Products in February 2021 - LATICRETE Launches New Construction Solution Products in February 2021 by LATICRETE International, Inc. 1,882

views 3 years ago 4 minutes, 7 seconds - This video shares detailed instructions on how to use 2 key surveying tools, the NIVCOMP™ and Elevation Pin System when ...
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Glass Tile Adhesive Light
NXT Level Plus
NXT Level Flow
Other Products
Conclusion
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Evolution Of Phase Transitions A Continuum Theory

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What is a phase transition? - What is a phase transition? by Jonathon Riddell 3,885 views 2 years ago 12 minutes, 10 seconds - Hey everyone! I am back with a new guest speaker, Steven Silber. In this video Steven motivates the topic of thermodynamic ...
Intro
Preface
Change
Phase transitions
Studying phase transitions
Thermodynamic parameters
Why do they happen
Phase Transitions - Phase Transitions by Physical Chemistry 19,945 views 3 years ago 9 minutes, 38 seconds - Looking at the Gibbs energy shows us that ordered **phases**, (like a solid) will always undergo a **transition**, and convert to more ...
Phase Transitions
Free Energy Changes
Entropy
11.01 Phases of matter: Symmetry and Topology - Landau's theory of phase transitions - 11.01 Phases of matter: Symmetry and Topology - Landau's theory of phase transitions by Maurits Haverkort 990 views 2 years ago 46 minutes - Matter forms in different **phases**,. Iron, at ambient pressure goes through 7 different **phases**, as a function of temperature, including ...
Introduction
Eigenstates
Gibbs free energy
Order parameter

Taylor series
Second order phase transition
First order phase transition
Recap
Conclusion
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The Landau free energy - The Landau free energy by Jonathon Riddell 8,621 views 2 years ago 15 minutes - Hey everyone! Steve is back with another video on **phase transitions**,. This time he introduces the Landau free energy by example, ...
Phase Transitions
Symmetry
What Landau Theory Does
Ising Model
Phase Transition
Canonical Partition Function
Interaction Energy
Approximation to the Interaction Energy
Mean Field Approximation
Landau Ginzburg theory of Phase Transitions - Landau Ginzburg theory of Phase Transitions by Jos Thijssen 16,533 views 8 years ago 47 minutes - Landau Ginzburg **theory**, is introduced. Special attention is given to the Ginzburg criterion.
Ising Model
Partition Function of the Ising Model
The Partition Function
Critical Exponent
Find the Correlation Function
Calculate the Magnetization
Fluctuation Response Theorem
A Saddle Point Approximation
Greens Theorem
Saddle Point Approximation
Perturbation Theory
Helmholtz Equation
Correlation Function at the Critical Point
Summary
The Ginsburg Criterion
Mindscape 163 | Nigel Goldenfeld on Phase Transitions, Criticality, and Biology - Mindscape 163 | Nigel Goldenfeld on Phase Transitions, Criticality, and Biology by Sean Carroll 18,998 views 2 years ago 1 hour, 31 minutes - Physics is extremely good at describing simple systems with relatively few moving parts. Sadly, the world is not like that; many ...
Introduction
Phase Transitions
Phase Transition
Wordtune
Normalization Group
Criticality
Scale Free
Fluids
Turbulence
Peloton
Nonequilibrium
Universality
Coexistence
Sponsor
Scalefree behavior
Is there scalefree behavior

Phylogenetic trees
The unsolvable problem that launched a revolution in set theory - The unsolvable problem that launched a revolution in set theory by Aleph 0 137,369 views 1 year ago 7 minutes, 13 seconds - An introduction to the **Continuum**, Hypothesis - a problem in set **theory**, that cannot be proved correct or incorrect. _____ Help ...
Intro
Continuum Hypothesis
What is Independence?
ZFC Axioms
Model of ZFC
Godel's Strategy
Cohen's Strategy
Electroweak Theory and the Origin of the Fundamental Forces - Electroweak Theory and the Origin of the Fundamental Forces by PBS Space Time 868,680 views 3 years ago 15 minutes - Our universe seems pretty complicated. We have a weird zoo of elementary particles, which interact through very different ...
Intro
Beta Decay
Weak Interaction
Gauge Theory
Unitarity
Electroweak field
Questions
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Unification of space and time
Einstein's General Theory of Relativity
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Andrew Strominger introduction
Einstein and black holes
The black hole information paradox
Stephen Hawking's insights into black holes
Using string theory to understand black holes
Conformal symmetry
Andrew Strominger's view of string theory
The First Quantum Field Theory - The First Quantum Field Theory by PBS Space Time 1,535,164 views 6 years ago 15 minutes - Quantum mechanics is perhaps the most unintuitive **theory**, ever devised. And yet it's also the most successful, in terms of sheer ...
4.5-Ehrenfest Transitions - 4.5-Ehrenfest Transitions by Stuart Winikoff 2,825 views 2 years ago 11 minutes, 57 seconds - Hello everybody so today we're going to be finishing up our conversation on pure **phase transitions**, by talking about other ways ...
Percolation: a Mathematical Phase Transition - Percolation: a Mathematical Phase Transition by Spectral Collective 342,471 views 1 year ago 26 minutes -

SOURCES——————————————————————— Percolation – Béla Bollobás and Oliver Riordan Cambridge ...
Introduction
Definition – Bernoulli Percolation
Definition – Uniform Coupling
Exploration – High-Resolution Square Grid
Exploration – Questions and Kesten's Theorem
Exploration – Ising Model
Exploration – Critical Percolation
Exploration – Three-Dimensional Cubic Lattice and Beyond
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Intro
Phase Transitions in random constraint satisfaction problems. Phase transitions in MCMC. The threshold for hardness of counting independent sets.
Phase Transitions A phase transition is a transition from on state of matter to another (eg. water freezing or boiling) In statistical physics models it represents an abrupt change in the properties of the distribution e.g. clustering of solutions of random K-SAT
Affects of phase transitions What changes after a phase transition? Can include Multimodality of the distribution andlor clustering of the space of solutions a The onset of long range correlations between

sites
Random Constraint Satisfaction Problems Work of Mezard, Parisi, Zecchina Montanari, etc in the theory of spin glasses and the cavity method have revolutionized the study of random
Clustering Phase Transition Space of colorings undergoes a clustering transition When the average degrees almost all the colorings form a giant cluster
.The sing model is a probability distribution over configurations the Gibbs distribution
Hardcore model It is hard to exactly count independent sets on graphs of maximum degree 3 (Greenhillo) FITAS algorithm for approximating the partition function on graphs of maximum degreed when
Theorem (Mossel, Weitz, Wormald 09) On almost all random d-regular bipartite graphs the mixing time of any local reversible Markov chain is
computational threshold for approximate counting
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Standard approach to computing parameters
Theoretical uncertainties
What has gone wrong?
Hierarchies in phase transitions
High temperature effective field theory
Problem: renormalisation scale dependence

EFT solution: renormalisation scale independence
Problem: gauge dependence.
EFT solution: gauge independence
Problem: what is the thermal nucleation rate?
EFT solution: match to classical nucleation theory
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Monitoring system vs open system
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Structural Phase Transitions in Layered Transition Metal Compounds

The structural phase transition is one of the most fundamental problems in solid state physics. Layered transition-metal dichalcogenides provide us with a most exciting area for the study of structural phase transitions that are associated with the charge density wave (CDW). A large variety of structural phase transitions, such as commensurate and incommensurate transitions, and the physical proper ties related to the formation of a CDW, have been an object of intense study made for many years by methods employing modem microscopic techniques. Rather recently, efforts have been devoted to the theoretical understanding of these experimental results. Thus, McMillan, for example, has developed an elegant phenomenological theory on the basis of the Landau free energy expansion. An extension of McMillan's theory has provided a successful understanding of the successive phase transitions observed in the IT- and 2H-compounds. In addition, a microscopic theory of lattice instability, lattice dynamics, and lattice distortion in the CDW state of the transition-metal dichalcogenides has been developed based on their electronic structures. As a result, the driving force of the CDW formation in the IT- and 2H-compounds has become clear. Furthermore, the effect of lattice fluctuations on the CDW transition and on the anomalous behavior of various physical properties has been made clear microscopically.

Structural Phase Transitions in Layered Transition Metal Compounds

A survey of the main trends in two-dimensional magnetism research, starting with a general introduction to the field of low-dimensional magnetic systems, and progressing to a discussion of the theory of 2-D magnets, the applications of high and low temperature series expansions and spin waves, neutron scattering experiments on 2-D Ising and Heisenberg magnets, phase transitions, NMR and EPR, and field- induced phenomena in weakly anisotropic Heisenberg anti-ferromagnets. Annotation copyrighted by Book News, Inc., Portland, OR

Magnetic Properties of Layered Transition Metal Compounds

In the last two decades low-dimensional (low-d) physics has matured into a major branch of science. Quite generally we may define a system with restricted dimensionality d as an object that is infinite only in one or two spatial directions (d = 1 and 2). Such a definition comprises isolated single chains or layers, but also fibres and thin layers (films) of varying but finite thickness. Clearly, a multitude of physical phenomena, notably in solid state physics, fall into these categories. As examples, we may mention: • Magnetic chains or layers (thin-film technology). • Metallic films (homogeneous or heteroge- neous, crystalline, amorphous or microcristalline, etc.). • I-d or 2-d conductors and superconductors. • Intercalated systems. • 2-d electron gases (electrons on helium, semiconductor interfaces). • Surface layer problems (2-d melting of monolayers of noble gases on a substrate, surface problems in general). • Superfluid films of ~He or 'He. • Polymer physics. • Organic and inorganic chain conductors, superionic conductors. • I-d or 2-d molecular crystals and liquid crystals. • I-d or 2-d ferro- and antiferro electrics.

Magnetic Properties of Layered Transition Metal Compounds

Physics of New Materials After the discoveries and applications of superconductors, new ceramics, amorphous and nano-materials, shape memory and other intelligent materials, physics became more and more important, comparable with chemistry, in the research and development of advanced

materials. In this book, several important fields of physics-oriented new-materials research and physical means of analyses are selected and their fundamental principles and methods are described in a simple and understandable way. It is suitable as a textbook for university materials science courses.

Physics of New Materials

This book is a Festschrift in honour of Professor Kazuko Motizuki on the occasion of her retirement from Osaka University. She has been active in a variety of branches of solid state physics and, in particular, has made an important contribution to the theory of magnetism. The book reviews recent advances in magnetism of transition metal compounds, both for itinerant electron systems and localized spin systems. For the former systems, band calculational methods, correlation effects, and theoretical aspects of photoemission spectroscopy are reviewed generally, and then recent progress in the theoretical and experimental understanding of magnetic properties of various kinds of intermetallic compounds and intercalation compounds of transition-metal dichalcogenides are reviewed in detail. For the latter systems, attention is focused on quantum effects, frustration and competing interaction in low-dimensional systems. Main subjects treated in the book are Haldane gap-systems, singlet-ground-state systems, triangular spin systems, and quantum spin chains with competing interactions.

Recent Advances In Magnetism Of Transition Metal Compounds: Festschrift In Honour Of Professor K Motizuki

The phenomenon of superconductivity - after its discovery in metals such as mercury, lead, zinc, etc. by Kamerlingh-Onnes in 19]] - has attracted many scientists. Superconductivity was described in a very satisfactory manner by the model proposed by Bardeen, Cooper and Schrieffer, and by the extensions proposed by Abrikosov, Gorkov and Eliashberg. Relations were established between superconductivity and the fundamental properties of solids, resulting in a possible upper limit of the critical temperature at about 23 K. The breakthrough that revolutionized the field was made in 1986 by Bednorz and Muller with the discovery of high-temperature superconductivity in layered copper-oxide perovskites. Today the record in transition temperature is 133 K for a Hg based cuprate system. The last decade has not only seen a revolution in the size of the critical temperature, but also in the myriads of research groups that entered the field. In addition, high-temperature superconductivity became a real interdisciplinary topic and brought together physicists, chemists and materials scientists who started to investigate the new compounds with almost all the available experimental techniques and theoretical methods. As a consequence we have witnessed an avalanche of publications which has never occurred in any field of science so far and which makes it difficult for the individual to be thoroughly informed about the relevant results and trends. Neutron scattering has outstanding properties in the elucidation of the basic properties of high-temperature superconductors.

Neutron Scattering in Layered Copper-Oxide Superconductors

This is a book on one of the most fascinating and controversial areas in contemporary science of carbon, chemistry, and materials science. It concisely summarizes the state of the art in topical and critical reviews written by professionals in this and related fields.

Carbyne and Carbynoid Structures

The effect of reduced dimensionality, inherent at the crystallographic level, on the electronic properties of low dimensional materials can be dramatic, leading to structural and electronic instabilities—including supercond- tivity at high temperatures, charge density waves, and localisation—which continue to attract widespread interest. The layered transition metal dichalcogenides have engaged attention for many years, partly arising from the charge density wave effects which some show and the controlled way in which their properties can be modified by intercalation, while the development of epitaxial growth techniques has opened up promising areas based on dichalcogenide heterostructures and quantum wells. The discovery of high-temperature superconducting oxides, and the realisation that polymeric materials too can be exploited in a controlled way for various opto-electronic applications, have further sti- lated interest in the effects of structural dimensionality. It seems timely therefore to draw together some strands of recent research involving a range of disparate materials which share some common char- teristics of low dimensionality. This resulting volume is aimed at researchers with specialist interests in the particular materials discussed but who may also wish to examine the related phenomena observed in different systems, and at a more general solid state audience with broad interests in electronic properties and low dimensional phenomena. Space limitations have required us

to be selective as regards particular materials, though we have managed to include those as dissimilar as polymeric semiconductors, superconducting oxides, bronzes and layered chalcogenides.

Electron Spectroscopies Applied to Low-Dimensional Structures

Krätschmer and Huffman's revolutionary discovery of a new solid phase of carbon, solid C60, in 1990 opened the way to an entire new class of materials with physical properties so diverse that their richness has not yet been fully exploited. Moreover, as a by-product of fullerene research, carbon nanotubes were later identified, from which novel nanostructures originated that are currently fascinating materials scientists worldwide. Rivers of words have been written on both fullerenes and nanotubes, in the form of journal articles, conference proceedings and books. The present book offers, in a concise and self-contained manner, the basics of the science of these materials as well as detailed information on those aspects that have so far been better explored. Structural, electronic and dynamical properties are described as obtained from various measurements and state-of-the-art calculations. Their interrelation emerges as well as their possible dependence on, for example, preparation conditions or methods of investigation. By presenting and comparing data from different sources, experiment and theory, this book helps the reader to rapidly master the basic knowledge, to grasp important issues and critically discuss them. Ultimately, it aims to inspire him or her to find novel ways to approach still open questions. As such, this book is addressed to new researchers in the field as well as experts.

The Physics of Fullerene-Based and Fullerene-Related Materials

In Bird of Passage by Rudolf Peierls, we find a paragraph in which he de scribes his Cambridge days in the 1930s: On these [relativistic field theory] problems my main contacts were Dirac, and the younger theoreticians. These included in particular Nevill (now Sir Nevill) Mott, perhaps the friendliest among many kind and friendly people we met then. Professor Kamimura became associated with Sir Rudolf Peierls in the 1950s, when he translated, with his colleagues, Peierls's 1955 textbook, Quantum Theory of Solids, into Japanese. This edition, to which Sir Rudolf himself contributed a preface, benefitted early generations of Japanese solid state physicists. Later in 1974/5, during a sabbatical year spent at the Cavendish Laboratory, Professor Kamimura met and began a long association with Sir Nevill Mott. In particular, they developed ideas for disordered systems. One of the outcomes is a paper coauthored by them on ESR-induced variable range hopping in doped semiconductors. A series of works on disordered systems, together with those on two-dimensional systems, have served as building blocks for Physics of Interacting Electrons in Disordered Systems, in the International Series of Monographs on Physics, coauthored by Aoki and published in 1989 by the Oxford University Press. Soon after Professor Kamimura obtained a D. Sc. in 1959 for the work on the ligand field theory under the supervision ofMasao Kotani, his strong con nections in the international physical community began when he worked at the Bell Telephone Laboratories in 1961/64.

New Horizons in Low-Dimensional Electron Systems

There is considerable interest in the intrinsically multiscale structure and dynamics of complex electronic oxides, especially since these materials include those of technological importance, such as colossal magnetoresistance manganites and cuprate high temperature superconductors. Current microscopies, such as diffuse X-ray and inelastic neutron scattering, electromagnetic and acoustic response, NMR and scanning tunneling microscope probes, have revealed static and dynamic multiscale patterns in charge positioning, lattice structure and magnetic orientation, that respond to both external stress and magnetic field. These self-organized patterns include charge and orbital ordering; stripes in strain/spin; and labyrinth-like conductance modulations. The materials exhibit nanoscale phase segregation and mesoscale inhomogeneous clustering, and their phase transitions can have a percolative character.This volume gathers experimental and theoretical work on these exciting new developments in condensed matter physics and materials science.

Electronic Structure and Structural Phase Transitions in Crystalline Solids

Describing all aspects of the physics of transition metal compounds, this book provides a comprehensive overview of this unique and diverse class of solids. Beginning with the basic concepts of the physics of strongly correlated electron systems, the structure of transition metal ions, and the behaviours of transition metal ions in crystals, it goes on to cover more advanced topics such as metal-insulator transitions, orbital ordering, and novel phenomena such as multiferroics, systems with oxygen holes, and high-Tc superconductivity. Each chapter concludes with a summary of key facts and

concepts, presenting all the most important information in a consistent and concise manner. Set within a modern conceptual framework, and providing a complete treatment of the fundamental factors and mechanisms that determine the properties of transition metal compounds, this is an invaluable resource for graduate students, researchers and industrial practitioners in solid state physics and chemistry, materials science, and inorganic chemistry.

Proceedings of the Workshop, Intrinsic Multiscale Structure and Dynamics in Complex Electronic Oxides

In the last ten years, the chemistry and physics of materials with layered structures became an intensively investigated field in the study of the solid state. Research into physical properties of these crystals and especially investigations of their physical anisotropy related to the structural anisotropy has led to remarkable and perplexing results. Most of the layered materials exist in several polytypic modifications and can include stacking faults. The crystal structures are therefore complex and it became apparent that there was a great need for a review of the crystallographic data of materials approximating two-dimensional solids. This second volume in the series 'Physics and Chemistry of Materials with Layered Structures' has been written by specialists of different classes of layered materials. Structural data are reviewed and the most important relations between the structure and the chemical and physical properties are emphasized. The first three contributions are devoted to the transition metal dichalcogenides whose physical properties have been investigated in detail. The crystallographic data and crystal growth conditions are presented in the first paper. The second paper constitutes an incisive review of the phase transformations and charge density waves which have been observed in the metallic dichalcogenides. In two contributions the layered structures of newer ternary compounds are de scribed and the connection between structure and non-stoichiometry is discussed.

Transition Metal Compounds

Nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR), time differential perturbed angular correlations (TDPAC), and the Mössbauer effect (ME) have been applied to the study of charge density wave (CDW) systems. These hyperfine techniques provide unique tools to probe the structure and symmetry of commensurate CDWs, give a clear fingerprint of incommensurate CDWs, and are ideally suited for CDW dynamics. This book represents a new attempt in the series `Physics and Chemistry of Materials with Low-dimensional Structures' to bring together a consistent group of scientific results obtained by nuclear spectroscopy related to CDW phenomena in pseudo-one- and two-dimensional systems. The individual chapters contain: the theory of CDWs in chain-like transition metal tetrachalcogenides; NMR, NQR, TDPAC, and ME investigations of layered transition metal dichalcogenides; NMR studies of CDW-transport in chain-like NbSe3 and molybdenum bronzes; multinuclear NMR of KCP; high resolution NMR of organic conductors. This book is of interest to graduate students and all scientists who want to acquire a broader knowledge of nuclear spectroscopy techniques applied to CDW systems.

Crystallography and Crystal Chemistry of Materials with Layered Structures

Graphite intercalation compounds are a new class of electronic materials that are classified as graphite-based host guest systems. They have specific structural features based on the alternating stacking of graphite and guest intercalate sheets. The electronic structures show two-dimensional metallic properties with a large variety of features including superconductivity. They are also interesting from the point of two-dimensional magnetic systems. This book presents the synthesis, crystal structures, phase transitions, lattice dynamics, electronic structures, electron transport properties, magnetic properties, surface phenomena, and applications of graphite intercalation compounds. The applications covered include batteries, highly conductive graphite fibers, exfoliated graphite and intercalated fullerenes and nanotubes.

INIS Atomindex

This book advances understanding of light-induced phase transitions and nonequilibrium orders that occur in a broken-symmetry system. Upon excitation with an intense laser pulse, materials can undergo a nonthermal transition through pathways different from those in equilibrium. The mechanism underlying these photoinduced phase transitions has long been researched, but many details in this ultrafast, non-adiabatic regime still remain to be clarified. The work in this book reveals new insights into this phenomena via investigation of photoinduced melting and recovery of charge density waves

(CDWs). Using several time-resolved diffraction and spectroscopic techniques, the author shows that the light-induced melting of a CDW is characterized by dynamical slowing-down, while the restoration of the symmetry-breaking order features two distinct timescales: A fast recovery of the CDW amplitude is followed by a slower re-establishment of phase coherence, the latter of which is dictated by the presence of topological defects in the CDW. Furthermore, after the suppression of the original CDW by photoexcitation, a different, competing CDW transiently emerges, illustrating how a hidden order in equilibrium can be unleashed by a laser pulse. These insights into CDW systems may be carried over to other broken-symmetry states, such as superconductivity and magnetic ordering, bringing us one step closer towards manipulating phases of matter using a laser pulse.

Nuclear Spectroscopy on Charge Density Wave Systems

Complex metal alloys (CMAs) comprise a huge group of largely unknown alloys and compounds, where many phases are formed with crystal structures based on giant unit cells containing atom clusters, ranging from tens of to more than thousand atoms per unit cell. In these phases, for many phenomena, the physical length scales are substantially smaller than the unit-cell dimension. Hence, these materials offer unique combinations of properties which are mutually exclusive in conventional materials, such as metallic electric conductivity combined with low thermal conductivity, good light absorption with high-temperature stability, high metallic hardness with reduced wetting by liquids, etc.This book is the first of a series of books issued yearly as a deliverable to the European Community of the School established within the European Network of Excellence CMA. Written by reputed experts in the fields of metal physics, surface physics, surface chemistry, metallurgy, and process engineering, this book brings together expertise found inside as well as outside the network to provide a comprehensive overview of the current state of knowledge in CMAs.

Graphite Intercalation Compounds and Applications

Recent studies on two-dimensional systems have led to new insights into the fascinating interplay between physical properties and dimensionality. Many of these ideas have emerged from work on electrons bound to the surface of a weakly polarizable substrate such as liquid helium or solid hydrogen. The research on this subject continues to be at the forefront of modern condensed matter physics because of its fundamental simplicity as well as its connection to technologically useful devices. This book is the first comprehensive overview of experimental and theoretical research in this exciting field. It is intended to provide a coherent introduction for graduate students and non-experts, while at the same time serving as a reference source for active researchers in the field. The chapters are written by individuals who made significant contributions and cover a variety of specialized topics. These include the origin of the surface states, tunneling and magneto-tunneling out of these states, the phase diagram, collective excitations, transport and magneto-transport.

Physics Briefs

The history of low dimensional conductors goes back to the prediction, more than forty years ago, by Peierls, of the instability of a one dimensional metallic chain, leading to what is known now as the charge density wave state. At the same time, Frohlich suggested that an "ideal" conductivity could be associated to the sliding of this charge density wave. Since then, several classes of compounds, including layered transition metal dichalcogenides, quasi one-dimensional organic conduc tors and transition metal tri- and tretrachalcogenides have been extensively studied. The molybdenum bronzes or oxides have been discovered or rediscovered as low dimensional conductors in this last decade. A considerable amount of work has now been performed on this subject and it was time to collect some review papers in a single book. Although this book is focused on the molybdenum bronzes and oxides, it has a far more general interest in the field of low dimensional conductors, since several of the molybdenum compounds provide, from our point of view, model systems. This is the case for the quasi one-dimensional blue bronze, especially due to the availability of good quality large single crystals. This book is intended for scientists belonging to the fields of solid state physics and chemistry as well as materials science. It should especially be useful to many graduate students involved in low dimensional oxides. It has been written by recognized specialists of low dimensional systems.

Emergent States in Photoinduced Charge-Density-Wave Transitions

This book summarizes the current status of theoretical and experimental progress in 2 dimensional graphene-like monolayers and few-layers of transition metal dichalcogenides (TMDCs). Semicon-

ducting monolayer TMDCs, due to the presence of a direct gap, significantly extend the potential of low-dimensional nanomaterials for applications in nanoelectronics and nano-optoelectronics as well as flexible nano-electronics with unprecedented possibilities to control the gap by external stimuli. Strong quantum confinement results in extremely high exciton binding energies which forms an interesting platform for both fundamental studies and device applications. Breaking of spatial inversion symmetry in monolayers results in strong spin-valley coupling potentially leading to their use in valleytronics. Starting with the basic chemistry of transition metals, the reader is introduced to the rich field of transition metal dichalcogenides. After a chapter on three dimensional crystals and a description of top-down and bottom-up fabrication methods of few-layer and single layer structures, the fascinating world of two-dimensional TMDCs structures is presented with their unique atomic, electronic, and magnetic properties. The book covers in detail particular features associated with decreased dimensionality such as stability and phase-transitions in monolayers, the appearance of a direct gap, large binding energy of 2D excitons and trions and their dynamics, Raman scattering associated with decreased dimensionality, extraordinarily strong light-matter interaction, layer-dependent photoluminescence properties, new physics associated with the destruction of the spatial inversion symmetry of the bulk phase, spin-orbit and spin-valley couplings. The book concludes with chapters on engineered heterostructures and device applications such as a monolayer MoS2 transistor. Considering the explosive interest in physics and applications of two-dimensional materials, this book is a valuable source of information for material scientists and engineers working in the field as well as for the graduate students majoring in materials science.

Basics of Thermodynamics and Phase Transitions in Complex Intermetallics

This book explores synthesis, structural changes, properties, and potential applications of transition metal (TM) compounds. Over three sections, chapters cover such topics as the synthesis of pentoxide vanadium (V2O5), the effect of TM compounds on structural, dielectric properties and high-temperature superconductors, and TM-doped nanocrystals (NCs).

Two-Dimensional Electron Systems

This volume is a translation and revision of the Original Russian version by Baryahktar. It covers all of the main fields involved in Condensed Matter Physics, such as crystallography, electrical properties, fluids, magnetism, material properties, optics, radiation, semiconductors, and superconductivity, as well as highlights of important related subjects such as quantum mechanics, spectroscopy, and statistical mechanics. Both theoretical and experimental aspects of condensed matter are covered in detail. The entries range from very short paragraphs on topics where definitions are needed, such as Bloch's law, clathrate compound, donor, domain, Kondo lattice, mean free path, and Wigner crystal, to long discussions of more general or more comprehensive topics such as antiferromagnetism, crystal lattice dynamics, dislocations, Fermi surface, Josephson effect, luminescence, magnetic films, phase transitions and semiconductors. The main theoretical approaches to Condensed Matter Physics are explained. There are several long tables on, for example, Bravais lattices, characteristics of magnetic materials, units of physical quantities, symmetry groups. The properties of the main elements of the periodic table are given. Numerous entries not covered by standard Solid State Physics texts o Self-similarity o The adiabatic approximation o Bistability Emphasis on materials not discussed in standard texts o Activated carborn o Austenite o Bainite o Calamitics o Carbine o Delat phase o Discotics o Gunier-Preston zones o Heterodesmic structures o Heusler Alloys o Stress and strain deviators o Vicalloy · Each entry is fully cross-referenced to help tracking down all aspects of a topic under investigation Highly illustrated to clarify many concepts

Low-Dimensional Electronic Properties of Molybdenum Bronzes and Oxides

With contributions by numerous experts

Two-Dimensional Transition-Metal Dichalcogenides

This book is aimed at advanced undergraduates, graduate students and other researchers who possess an introductory background in materials physics and/or chemistry, and an interest in the physical and chemical properties of novel materials, especially transition metal oxides.New materials often exhibit novel phenomena of great fundamental and technological importance. Contributing authors review the structural, physical and chemical properties of notable 4d- and 5d-transition metal oxides discovered over the last 10 years. These materials exhibit extraordinary physical properties that differ

significantly from those of the heavily studied 3d-transition metal oxides, mainly due to the relatively strong influence of the spin-orbit interaction and orbital order in 4d- and 5d materials. The immense growth in publications addressing the physical properties of these novel materials underlines the need to document recent advances and the current state of this field. This book includes overviews of the current experimental situation concerning these materials.

Structural Phase Transitions

This book provides final year undergraduate students, graduate students, research scientists and engineers with an up-to-date overview of the power of using surface analytical techniques for probing complex solid surfaces and lubricants as well as for understanding their interactions in tribological systems. The first three introductory chapters illustrate the need for surface analysis in tribology and the essentials of the analytical techniques. Following these, eight chapters on applications give insight into the contribution of the major analytical techniques to tribology. These chapters are divided into three groups. The first group deals with the applications of surface analytical techniques to the study of the adhesion, friction, deformation, wear, structure and chemistry of solid surfaces at the atomic scale or in well-defined conditions. The second group focuses mainly on solid lubricants and tribological surface modifications. Lastly, the third group covers liquid lubricants in molecularly thin-film lubrication and in boundary lubrication and their interactions with surfaces.

Transition Metal Compounds

The objective in initiating this series in 1980 was to provide an in-depth review of advances made in the understanding key aspects of surface chemistry and physics through the application of new techniques to the study of well-defined surfaces. Since then the field of surface science has greatly matured, and further important techniques, particularly scanning probe microscopies, have been successfully assimilated into the applications armoury of the surface scientist. The present volume is a series of timely reviews by many of the current experts in the field of phase transitions and adsorbate-induced surface restructuring. No aspect of the science of solid surfaces can be fully understood without accounting for the structural diversity of surfaces, now revealed in atomic detail by techniques based on diffraction and scanning probe microscopies. For example, it is now clear to those working in heterogeneous catalysis that adsorbate-induced restructuring of surfaces can play a critical role in phenomena such as bistability, kinetic oscillations, and promotion and poisoning. Structural transitions at surfaces can also play a key role in determining the electronic properties of surfaces, reviewed in volume 5.

Encyclopedic Dictionary of Condensed Matter Physics

Many of the most important properties of materials in high-technology applications are strongly influenced or even controlled by the presence of solid interfaces. In this work, leading international authorities review the broad range of subjects in this field focusing on the atomic level properties of solid interfaces.

Structural Phase Transitions I

By browsing about 10 000 000 scientific articles of over 200 major journals some 200 000 publications were selected. The extracted data is part of the following material research fields: crystal structures (S), phase diagrams (C) and intrinsic physical properties (P). These research field codes as well as the chemical systems investigated in each publication were included in the present work. The aim of this Bibliography is to provide researchers with a comprehensive compilation of all up to now published scientific publications on inorganic systems in only three handy volumes.

Frontiers of 4D- and 5D-transition Metal Oxides

Layered crystals, characterized by a quasi-two-dimensional character of certain physical properties, play an interesting role in surface science. First of all they provide excellent inert substrates for epitaxial deposition and physisorption studies. The surfaces of layered crystals, however, are interesting in their own right because they make a relevant class of low-dimensional phenomena accessible to surface probes. Change density waves, incommensurate structures, phonon anomalies and high Tc superconductivity are well known examples. This book collects a series of review articles written by outstanding specialists on the structural assessment and spectroscopy of layered structures with surface-sensitive

probes such as scanning microscopy and helium atom scattering, the theoretical analysis of their electronic and vibrational surface states, and the investigation of physisorbed overlayers.

Surface Diagnostics In Tribology: Fundamental Principles And Applications

This Second Edition provides solid state scientists, who are not necessarily experts in crystallography, with an understandable and comprehensive guide to the new International Tables for Crystallography. The basic ideas of symmetry, lattices, point groups, and space groups are explained in a clear and detailed manner. Notation is introduced in a step-by-step way so that the reader is supplied with the tools necessary to derive and apply space group information. Of particular interest in this second edition are the discussions of space groups application to such timely topics as high-temperature superconductors, phase transitions, semiconductor superlattices, incommensurate modulation, and icosahedral symmetry. Key Features * Explains the use of space groups to non-crystallographers * Applies space groups to current topics, such as high-temperature superconductors and phase transitions * Includes extensive appendixes, covering all aspects of space groups, including incommensurate modulations and disorder

Phase Transitions and Adsorbate Restructuring at Metal Surface

This book is dedicated to the fundamental physical aspects of stability, the influence of structural defects on the properties and structural phase transformations of BCC alloys. The authors present patterns that occur in the structural-phase states of functional alloys with low stability or instability under thermal cycling effects. Structural-phase transformations and the physical laws governing the influence of the thermomechanical effect on the properties of alloys are examined to advance development of technological processes for processing functional materials. Features: Studies the correlation between structural phase states and changes in the physico-mechanical properties of intermetallic compounds Explores the influence of thermomechanical cycling on the properties of functional alloys Details low-stability pretransition states in alloys

Materials Interfaces

Physics of New Materials starts from basic science, specially solid-state physics, and then moves into the research and development of advanced materials. The emphasis of the discussions is concentrated on the electronicand atomic structures and properties of transition-metal systems, liquidand amorphous materials, the nano-phase materials, layered compounds, martensite and other structural-transformed materials, and ordered alloys. Though these discussions, the physical aspects and principles ofnew materials, such as strong ferromagnetic alloys, shape memory alloys, amorphous alloys, ultra-fine particles, intercalated layered compounds, deformable ceramics, and nuclear-physics techniques. In addition to these theoretical treatments, modern experimental techniques, exemplified by M|ssbauer spectroscopy and electron microscopy, demonstrate the vast scope of schemes needed in the development of new materials.

Bibliography

Surface Properties of Layered Structures