# Inorganic Chemistry in Focus III

*Edited by*
*Gerd Meyer, Dieter Naumann and Lars Wesemann*


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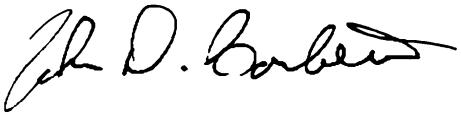
*Dedicated to Professor John D. Corbett on the occasion of his 80th birthday*



## In Praise of Synthesis

This book is about passion. A passion for chemistry. A passion for John D. Corbett, Distinguished Professor of Science and Humanities at Iowa State University of Science and Technology and Senior Chemist at the Ames Laboratory. A passion and admiration for John's way of conducting research in solid state chemistry and for the way he passes on his vast amount of accumulated knowledge to his students, postdoctoral associates and the community as a whole. John Corbett is a truly outstanding solid state inorganic chemist, an individual of immense and different talents, who has influenced not only his discipline but, in many ways, has led the renaissance in solid state chemistry over the past several decades.

"First comes the synthesis." What else? But it is as simple as that. It must have been sheer luck, both for him and for the scientific community, or perhaps, fate, that John D. Corbett, born in Yakima, Washington, on March 23$^{rd}$, 1926, with a Ph.D. in physical chemistry (!) from the University of Washington, received a joint appointment in 1952 as Assistant Professor at the Department of Chemistry and as Associate Chemist at the Ames Laboratory of the Atomic Energy Commission (now the U.S. Department of Energy), founded and guided by the late Frank H. Spedding. It is no wonder that, after some 50 years, John D. Corbett was the recipient of the 11$^{th}$ Frank H. Spedding Award. This honour came late, after many others, of which his election to the National Academy of Sciences (1992) and the ACS Awards in Inorganic Chemistry (1986) and for Distinguished Service in the Advancement of Inorganic Chemistry (2000), are three other prominent examples.

But first the "synthesis" had to come! John was interested in reduced metal halides, particularly for the post-transition metals cadmium, gallium, and bismuth (his Ph.D. dissertation was on anhydrous aluminum halides and mixed halide intermediates, a good start for what was to come!). However, he was not yet actively interested in rare-earth metals and their remarkable solubility in their halides. But these elements lured him one floor below where Adrian Daane headed the metallurgy section of Spedding's empire. He knew how to produce rare-earth metals with high purity and in sufficient quantity and also how to handle tantalum containers. What if one "gave it a try" and reduced some rare-earth metal halides (John insists that this term is used correctly) from their respective metals at high temperatures under appropriate conditions,

in tantalum or niobium containers? This soon gave rise to a whole number of rare-earth metal subhalides, both metallic and salt-like.

It is surely always difficult to imagine the unimaginable. The "eighth wonder of the rare-earth world" had yet to be discovered. It was, in fact, discovered in a tantalum ampoule as the fantastic gadolinium sesquichloride. Clusters became a passion, they were found everywhere throughout the periodic table, of course with reduced rare-earth metal halides and their "garbage chemistry", as Bob McCarley coined it, in a friendly manner. Zirconium chemistry was an obsession for while, post-transition polyanions and cations, Zintl phases, tellurides, non-carbon fullerenes and, recently, approximants and quasicrystals. John beams boyishly when he talks about his and his co-workers latest achievements. "But there is no time to rest. There is so much which is unimaginable out there". "Explore!" "Lord, grant me patience, but hurry."

John's contributions to the development of solid state chemistry are particularly noteworthy. Together with industrial and academic chemists interested in this subject, Corbett and others have encouraged and fostered this important area of chemistry. Likewise, in the role of teacher and advisor, John Corbett motivates and encourages young people towards a career in science. His influence on an entire generation of inorganic and solid state chemists *uniquely* endears John to his many friends around the world.

As a writer and author John is also well known for many "Corbett Quotables", of which we have already mentioned a few above. Here are a few other enduring examples:

"Exploratory solid state synthesis seems to be the only workable route to new phases because of a general inability to predict relative phase stabilities and thence structures or compositions", published in "$K_4La_6I_{14}Os$: A new Structure Type for Rare-Earth-Metal Cluster Compounds that Contain Discrete Tetrahedral $K_4I^{3+}$ Units." S. Uma, J. D. Corbett, *Inorg. Chem.* **1999**, *38*, 3831–3835.

"The diverse instances in which efficient, space-filling, bonding arrangements repeat is both surprising and pleasing", published in "Synthesis, Structure, and Bonding of $BaTl_3$: An Unusual Competition between Cluster and Classical Bonding in the Thallium Layers." D.-K. Seo, J. D. Corbett, *J. Am. Chem. Soc.* **2002**, *124*, 415–420.

"The best discoveries in an unprincipled area are often those that one stumbles upon during experiments designed with plausible but incorrect or naïve ideas regarding possible compounds or structural targets", published in "Diverse Solid-State Clusters with Strong Metal–Metal Bonding. In Praise of Synthesis." J. D. Corbett, *J. Chem. Soc., Dalton Trans.* **1996**, 575–587.

"There is *much* to be discovered that cannot be imagined. It is the wonder and excitement of finding the unprecedented and unimaginable that makes research enjoyable, even exhilarating, and worthwhile." Published in "Exploratory Synthesis in the Solid State. Endless Wonders." J. D. Corbett, *Inorg. Chem.* **2000**, *39*, 5178–591.

Needless to say, John's energy and enthusiasm for chemistry have not diminished over 50-plus years of active research but, on the contrary, appear to be on

the increase. His recent discoveries of large Buckyball networks of indium, his election to the National Academy of Sciences, and his Department of Energy's Division of Basic Energy Sciences Award for Sustained Outstanding Research, all attest to his achievements. We wish John a very happy birthday and look forward to many more "Corbett Quotables" in the years to come.

Evanston, IL, and Cologne
Summer 2006

Kenneth R. Poeppelmeier & Gerd Meyer

## Contents

**Dedicated** *V*

**In Praise of Synthesis** *VII*

**Preface** *XIX*

**List of Contributors** *XXI*

**Biographical Sketches** *XXV*

**1 Inter-electron Repulsion and Irregularities in the Chemistry of Transition Series** *1*
*David A. Johnson*
1.1 Introduction: Irregularities in Lanthanide Chemistry *1*
1.2 A General Principle of Lanthanide Chemistry *4*
1.3 Extensions of the First Part of the Principle *6*
1.4 Extensions of the Second Part of the Principle *8*
1.5 The Tetrad Effect *9*
1.6 The Diad Effect *11*
References *13*

**2 Stereochemical Activity of Lone Pairs in Heavier Main-group Element Compounds** *15*
*Anja-Verena Mudring*
2.1 Introduction *15*
2.2 When Does a Lone Pair of Electrons Become Stereochemically Active? – Observations *16*
2.3 Theoretical Concepts *17*
2.3.1 Molecular/Complex Compounds *18*
2.3.2 Solid Materials *20*
2.4 Conclusions *25*
Acknowledgments *26*
References *26*

**3 How Close to Close Packing?** *29*
*Hideo Imoto*
3.1 Introduction *29*
3.2 Essential Features of Close Packing *30*
3.3 Parameter Definitions *30*
3.4 Correlation Between *D* and *N* *33*
3.5 Transformation of Close-packing Arrangements *35*
3.6 Close-packing of Cations or of Anions? *38*
3.7 What Determines the Structure? *41*
Appendix. ICSD Codes, *D* and *N* Parameters of the Structures Used *42*
References *44*

**4 Forty-five Years of Praseodymium Di-iodide, $PrI_2$** *45*
*Gerd Meyer and Andriy Palasyuk*
Foreword *45*
4.1 Introduction *46*
4.2 Phases and Structures in the System Praseodymium-Iodine *47*
4.2.1 Synthesis Generalities *47*
4.2.2 Structural Principles *48*
4.3 $PrI_2$: Phases and Phase Analysis *51*
4.4 Conclusions *58*
Acknowledgments *59*
References *59*

**5 Centered Zirconium Clusters: Mixed-halide Systems** *61*
*Martin Köckerling*
Foreword *61*
5.1 The Basics of Zirconium Cluster Chemistry *61*
5.2 Motivation *62*
5.3 Mixed-Chloride-Iodide Zirconium Cluster Phases with a 6:12–Metal:Halide Ratio *63*
5.4 Mixed Chloride–Iodide Zirconium Cluster Phases with a 6:13 Metal:Halide Ratio *64*
5.5 Mixed Chloride–Iodide Zirconium Cluster Phases with a 6:14 Metal:Halide Ratio *67*
5.6 Mixed Chloride–Iodide Zirconium Cluster Phases with a 6:15 Metal:Halide Ratio *71*
5.7 Mixed Chloride–Iodide Zirconium Cluster Phases with a 6:18 Metal:Halide Ratio – Products from Solid-state Reactions *76*
5.8 Outlook *77*
Acknowledgments *77*
References *77*

**6 Titanium Niobium Oxychlorides: Ligand Combination Strategy for the Preparation of Low-dimensional Metal Cluster Materials** *79*
*Ekaterina V. Anokhina and Abdessadek Lachgar*
Abstract *79*
6.1 Introduction *79*
6.1.1 Cluster Connectivity and Framework Dimension *81*
6.1.2 The Ligand Combination Approach to Creating Anisotropic Frameworks *82*
6.2 Overview of the Chemistry of Niobium Chloride and Niobium Oxide Cluster Compounds *83*
6.2.1 Synthesis and Chemical Properties *83*
6.2.2 Electronic Structure, Redox and Magnetic Properties *84*
6.3 Niobium Oxychloride Cluster Compounds *85*
6.3.1 One-dimensional Cluster Frameworks *85*
6.3.1.1 Frameworks Built from Clusters with Five Oxygen Ligands *85*
6.3.1.2 Frameworks Built of Clusters with Six Oxygen Ligands *86*
6.3.2 Two-dimensional Cluster Frameworks *88*
6.3.2.1 2D Oxychloride Frameworks with a Honeycomb-like Structure *88*
6.3.2.2 Pillared 2D Oxychloride Frameworks *90*
6.3.2.3 2D Framework with Graphite-like Cluster Connectivity *90*
6.4 Summary of Crystallographic Data on Titanium Niobium Oxychlorides *93*
6.4.1 Effect of the Total Number of Ligands *93*
6.4.2 Cluster Configuration *95*
6.4.2.1 Relationships Between Ligand Arrangement and Direct Inter-cluster Linkages *95*
6.4.2.2 Relationships Between the Ligand Arrangement and Inter-cluster Linkages via Counter-ions *96*
6.4.3 Anion Segregation *97*
6.4.4 Structure-determining Factors in the Absence of "Hard" Cations *97*
6.5 Electronic Configuration of Niobium Oxychloride Clusters *99*
6.6 Conclusion and Outlook *100*
References *101*

**7 Trinuclear Molybdenum and Tungsten Cluster Chalcogenides: From Solid State to Molecular Materials** *105*
*Rosa Llusar and Cristian Vicent*
7.1 Introduction *105*
7.2 Synthesis and Structure of Molecular $M_3Q_4$ and $M_3Q_7$ Cluster Complexes *107*
7.2.1 Solid-state Synthesis: Dimensional Reduction *108*
7.2.2 Solution Routes: Excision *109*
7.2.3 Ligand Exchange Reactions *112*
7.2.3.1 $M_3Q_4$ Cluster Complexes *112*
7.2.3.2 $M_3Q_7$ Cluster Complexes *113*

7.3 Trinuclear Clusters as Building Units *115*
7.3.1 Molecular Conductors Based on $M_3Q_7$ Cluster Complexes *115*
7.3.2 Formation of Supramolecular Adducts *117*
Acknowledgments *119*
References *119*

**8 Current State on (B,C,N) Compounds of Calcium and Lanthanum** *121*
*H.-Jürgen Meyer*
8.1 Introduction *121*
8.2 Problems and Pitfalls of some Calcium Compounds with (mixed) B,C,N Anions *121*
8.2.1 Borides of Calcium and Lanthanum *123*
8.2.2 The $CaC_2$ Problem and $Ca_3Cl_2C_3$ *124*
8.2.3 Calcium Nitride and Calcium Carbodiimides *126*
8.2.4 Calcium Nitridoborates *126*
8.2.5 A Comparison of $Ca_3(BN_2)_2$ and $Sr_3(BN_2)_2$ Structures *126*
8.3 Metal-nitridoborates *129*
8.3.1 Electronic Considerations *129*
8.4 Lanthanum Nitridoborates *131*
Compounds in Ca-B-N and La-B-N systems *132*
8.4.1 Nitridoborate Ions *133*
8.4.2 Structures of Lanthanum Nitridoborates *134*
8.5 Outlook *137*
Acknowledgments *138*
References *138*

**9 Compositional, Structural and Bonding Variations in Ternary Phases of Lithium with Main-group and Late-transition Elements** *141*
*Claude H. Belin, Monique Tillard*
9.1 Introduction *141*
9.2 Tuning Structures and Properties in Lithium Binary and Ternary Systems *142*
9.3 Clustering in Condensed Lithium Ternary Phases: A Way Towards Quasicrystals *143*
9.4 Exploration of New Lithium Ternary Systems Containing Ag, Zn, Al, Si, Ge *144*
9.4.1 Background *144*
9.4.2 The System Li-Al-Ag *145*
9.4.3 Compositional and Structural Variations in the System Li-Al-Si *146*
9.4.4 The Tetragonal Compound $Li_9AlSi_3$, a Good Anodic Material *148*
9.5 The Intermetallic Li-Zn-Ge System, from Electron-poor to Electron-rich Phases *149*
9.5.1 The Electron-poor Hexagonal Phase LiZnGe *149*
9.5.2 The True Cubic Configuration of the Compound $Li_2ZnGe$ *150*

9.5.3 The Li-rich Compound $Li_8Zn_2Ge_3$ with an Open-layered Anionic Framework *152*
9.6 Concluding Remarks *154*
References *154*

**10 Polar Intermetallics and Zintl Phases along the Zintl Border** *157*
*Arnold M. Guloy*
10.1 "First comes the synthesis . . ." – J. D. Corbett *157*
10.2 What are Intermetallics? *157*
10.3 The Zintl-Klemm Concept *160*
10.4 "Electron-poor" Polar Intermetallics *161*
10.5 Intermetallic $\pi$-Systems *162*
10.6 Some Final Remarks *168*
References *169*

**11 Rare-earth Zintl Phases: Novel Magnetic and Electronic Properties** *173*
*Susan M. Kauzlarich and Jiong Jiang*
11.1 Introduction *173*
11.2 Structure *174*
11.3 Resistivity *177*
11.4 Magnetic Properties *178*
11.5 Magnetoresistance *179*
11.6 Summary *180*
Acknowledgments *181*
References *181*

**12 Understanding Structure-forming Factors and Theory-guided Exploration of Structure–Property Relationships in Intermetallics** *183*
*Dong-Kyun Seo, Li-Ming Wu and Sang-Hwan Kim*
12.1 Introduction *183*
12.2 $Mn_{14}Al_{56+x}Ge_{3-x}$ (x=0.00, 0.32, 0.61) *184*
12.3 $La_{5-x}Ca_xGe_4$ ($x$=3.37, 3.66, 3.82) and $Ce_{5-x}Ca_xGe_4$ ($x$=3.00, 3.20, 3.26) *188*
12.4 Concluding Remarks *191*
Acknowledgments *191*
References *192*

**13 Ternary and Quaternary Niobium Arsenide Zintl Phases** *195*
*Franck Gascoin and Slavi C. Sevov*
13.1 Introduction *195*
13.2 New Main-group Arsenides *197*
13.3 Compounds Based on Isolated $[NbAs_4]$ Tetrahedral Centers *199*

13.4 Compounds Based on Edge-sharing Dimers of [$NbAs_4$] Tetrahedra *204*
References *206*

**14 The Building-block Approach to Understanding Main-group-metal Complex Structures – More than just "Attempting to Hew Blocks with a Razor"** *209*
*Peter K. Dorhout*
14.1 Introduction *209*
14.2 The Building-block Approach *210*
14.2.1 Quaternary Rare-earth Metal Chalcophosphates *210*
14.2.2 Quaternary Rare-earth Metal Chalcoarsenites and Antimonites *213*
14.2.3 Quaternary Rare-earth Metal Chalcotrielates and Tetrelates *215*
14.3 Summary *221*
References *222*

**15 Cation-deficient Quaternary Thiospinels** *225*
*Ashok K. Ganguli, Shalabh Gupta and Gunjan Garg*
15.1 Introduction *225*
15.2 $Cu_{5.5}Si\square_{1.5}Fe_4Sn_{12}S_{32}$ *227*
15.3 $Cu_{5.47}Fe_{2.9}Sn_{13.1}S_{32}$ *233*
15.4 $Cu_{7.38}Mn_4Sn_{12}S_{32}$ (1) and $Cu_{7.07}Ni_4Sn_{12}S_{32}$ (2) *235*
15.5 Conclusions *236*
References *236*

**16 A New Class of Hybrid Materials via Salt-inclusion Synthesis** *239*
*Shiou-Jyh Hwu*
16.1 Introduction *239*
16.2 General Approach to Salt-inclusion Synthesis *241*
16.3 Examples and Discussion *242*
16.3.1 Zeolite-like Transition Metal Containing Porous Compounds *242*
16.3.2 Non-centrosymmetric Solids (NCSs) *244*
16.3.3 Solids Containing Periodic Arrays of Transition-metal Nanostructures *247*
16.4 Final Remarks *248*
Acknowledgments *249*
References *249*

**17 Layered Perrhenate and Vanadate Hybrid Solids: On the Utility of Structural Relationships** *251*
*Paul A. Maggard and Bangbo Yan*
17.1 Introduction *251*
17.2 Heterometallic Perrhenates *252*
17.2.1 Background: Molecular and Condensed Metal-perrhenates *252*
17.2.2 Copper- and Silver-perrhenate Hybrids *253*

17.2.3 Metal-coordinated Pillars in Perrhenate Hybrids *256*
17.3 Heterometallic Vanadates *259*
17.3.1 Background: Layered Vanadate Species *259*
17.3.2 Layered Heterometallic Vanadates: Charge Density Matching *261*
17.3.3 Heterometallic Reduced Layered Vanadates *262*
17.4 Conclusions *265*
Acknowledgments *265*
References *265*

**18 Hydrogen Bonding in Metal Halides: Lattice Effects and Electronic Distortions** *267*
*James D. Martin*
18.1 Introduction *267*
18.2 A Hierarchy of Structure-directing Forces *268*
18.3 Hydrogen Bond Influence on Melts and Crystallization *269*
18.4 Electronic Implications of Hydrogen Bonding *272*
18.5 Conclusions *275*
Acknowledgments *276*
References *276*

**19 Syntheses and Catalytic Properties of Titanium Nitride Nanoparticles** *279*
*Stefan Kaskel*
19.1 Introduction *279*
19.2 Synthesis of TiN Nanoparticles *280*
19.3 Titanium Nitride Nanoparticles in Hydrogen Storage Applications *285*
19.4 Catalytic Properties of TiN Nanoparticles in Solution *288*
19.5 Catalytic Properties *289*
References *292*

**20 Solventless Thermolysis: A Possible Bridge Between Crystal Structure and Nanosynthesis?** *295*
*Ling Chen and Li-Ming Wu*
20.1 Introduction *295*
20.2 Synthesis Methods *295*
20.3 Solventless Thermolysis and Some Examples *296*
20.3.1 $Cu_2S$ Nanodisks *297*
20.3.2 NiS Nanorods and Nanotrigonal Prisms *297*
20.3.3 $Bi_2S_3$ Nanowires, Rods and Fabric *298*
20.3.4 $Pb_3O_2Cl_2$ Nanobelts *298*
20.4 Control of the Nanoproduct Morphology Through the State of the Precursor *299*

20.5 Crystal Structure of the Precursor versus the Morphology and Distribution of the As-synthesized Nanoproduct: A Possible Bridge Between these Two? *300*
20.6 Conclusion and Prospects *302*
Acknowledgment *302*
References *303*

**21 New Potential Scintillation Materials in Borophosphate Systems** *305*
*Jing-Tai Zhao and Cheng-Jun Duan*
21.1 Introduction *305*
21.2 Recent Studies on the Scintillation Luminescence Properties of Borophosphates *306*
21.2.1 The Crystal Structures of $Ba_3BP_3O_{12}$, $BaBPO_5$ and $Ba_3BPO_7$ *306*
21.2.2 The Preparation and X-ray-excited Intrinsic Scintillation Luminescence Properties of $Ba_3BP_3O_{12}$, $BaBPO_5$ and $Ba_3BPO_7$ *308*
21.2.3 The X-ray-excited Luminescence Properties of $Ce^{3+}$-activated $Ba_3BP_3O_{12}$, $BaBPO_5$ and $Ba_3BPO_7$ *316*
21.2.4 Potential Scintillation Material of $Ba_3BP_3O_{12}$: $Eu^{2+}$ *318*
21.3 Outlook *322*
References *323*

**Subject Index** *325*

## Preface

This third volume of *Inorganic Chemistry in Focus* is special in many ways. First, it is dedicated to Professor John D. Corbett of Iowa State University, on the occasion of his 80th birthday on March 23rd, 2006. Second, with its 21 articles, it focuses almost entirely on inorganic solid state chemistry, although it covers a wide area stretching from theoretical considerations via new syntheses, structures and physical properties to applications. Third, these articles are written exclusively by John Corbett's former graduate students and by postdoctoral associates from throughout the world, who have all entered academia. The readers of this book will certainly notice John D. Corbett's influence on the research contained in it, which in this way will be passed on to the next generation, influencing the (solid state) chemists of the future. This book, therefore, is also a documentation of how science progresses and develops over time and how the knowledge of chemistry is disseminated. It is encouraging that all of the authors have found the time to write articles for this special book.

It is to be hoped that the celebrant will enjoy perusing through the chemistry presented in his birthday present, and also that there will be a wide-ranging and appreciative readership. Finally, we all wish John D. Corbett a very happy birthday, *ad multos annos*.

Cologne and Tübingen, Germany
Summer 2006

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# Subject Index


***a***

absorption spectrum of $BaBPO_5$ 314
alkylammonium cations 269
alloy(s) 158
anion segregation 97

***b***

(B,C,N) compounds 121 ff
  of calcium and lanthanum 121 ff
band structure
  of CaNi(BN) 137
  of $La_3(B_2N_4)$ 136
  of $La_3Ni_2(BN)_2N$ 137
  of $Li_2AlAg$ 145
  of $Li_2ZnGe$ 151
battery, anodic materials 148
Bergman polyhedra 143
body-centered cubic structure 29
borides of calcium and lanthanum 123
borophosphate systems 305 ff
building block approach 209 ff

***c***

calcium
  carbide ($CaC_2$) 124
  carbodiimide 126
  nitride 126
  nitridoborates 126 f
charge density matching 261
close(st) packing 29 ff
  cubic close(st) packing 29
  deviations from 30
  hexagonal close(st) packing 29
  radii 41
cluster(s)
  complexes $M_3Q_4$ and $M_3Q_7$ 107 f, 112 ff
  configuration 95
  connectivities 81
  excision of 109 f
  framework dimensions 81, 85 ff
  low-dimensional cluster materials 79 ff
  octahedral cluster units 81
  trinuclear molybdenum and tungsten 105 ff
  $[(Zr_6Z)X_{18}]$ 62
crown ethers 18 ff
crystal orbital Hamiltonian population (COHP) 21 ff
crystal orbital overlap population (COHP)
  for $Ca_5In_9Sn_6$ 165
  for $La_2Ca_3Ge_4$ 190
  for $SrCa_2In_2Ge$ 164
crystal packing forces 268
crystal structure(s)
  of $A_2EuM_2Se_6$ 218
  of $A_xNb_6Cl_{12}O_2$ 86
  of $ASmGeSe_4$ 216
  of $A_2Ti_2Nb_6Cl_{14}O_5$ 86
  of $A_5Ti_8Nb_{18}Cl_{53}O_{12}$ 88 f
  of $AgReO_4(pyz)$ 255, 257
  of $AgReO_4Co(pzc)_2(H_2O)_2$ 257
  of $AgReO_4Cu(pzc)_2$ 259
  of $AgReO_4Ni(pzc)_2(H_2O)_2$ 257
  of $BaBPO_5$ 307
  of $Ba_3BPO_7$ 307
  of $Ba_3BP_3O_{12}$ 306
  of $Ba_2NiS_3$ 166
  of $Ca_3(BN_2)_2$ 127 f
  of $Ca_3(BN_2)N$ 122
  of $CaB_{4-x}C_x$ 122
  of $CaB_6$ 122
  of $Ca_{11}(CN)_2N_6$ 122
  of $Ca_3Cl_2C_3$ 122
  of $Ca_3Cl_2(CBN)$ 122
  of $Ca_5In_9Sn_6$ 165
  of CaNi(BN) 136
  of $Co(pyz)V_4O_{10}$ 263 f
  of $CsCu_2Cl_3$ 271

of $Cs_2Cu_7(P_2O_7)_4 \cdot 6CsCl$ (CU-9) 245
of $Cs_5In_3As_4$ 198
of $Cs_{13}Nb_2In_6As_{10}$ 203
of $Cs_{24}Nb_2In_{12}As_{18}$ 203
of $Cs_2Ti_4Nb_6Cl_{18}O_6$ 87
of $Cs_2Ti_3(Nb_6Cl_{12.5}O_4)_2Cl_2$ 92
of $Cs_3[ZrCl_5][(Zr_6B)Cl_{15}]$ and derivatives 71 f
of $Cu_{5.47}Fe_{2.9}Sn_{13.1}S_{32}$ 233 f
of $Cu_{7.38}Mn_4Sn_{12}S_{32}$ 235
of $Cu_{7.07}Ni_4Sn_{12}S_{32}$ 235
of $[Cu_2(pzc)_2(H_2O)_2(ReO_4)]$ 254
of $Cu(pyz)_2V_6O_{16}(H_2O)_{0.22}$ 262
of $Cu_{5.5}Si\square_{1.5}Fe_4Sn_{12}S_{32}$ 227 f
of $EuIn_2P_2$ 175
of $Eu_3InP_3$ 175 f
of $Eu_3In_2P_4$ 175
of $(H_2NEt_2)_2Zr_2Cl_{10}$ 273
of $(H_2NMe_2)Cu_2Cl_3$ 271
of $KBa_2InAs_3$ 199
of $K_2Cs_3Cu_3(P_2O_7)_2Cl_3$ (CU-2) 243
of $K_4[(Zr_6C)Br_{18}]$ and derivatives 76 f
of $La_3(B_2N_4)$ 136
of $La_5(B_3N_6)(BN_3)$ 135
of $La_6(B_3N_6)(BN_3)N$ 135
of LaNi(BN) 136
of $La_3Ni_2(BN)_2N$ 136
of $Li_{17}Ag_3Sn_6$ 167
of $Li_5AlSi_2$ 147
of $Li_9AlSi_3$ 147
of $Li_2Ga_7$ 143
of $Li_5Ga_4$ 143
of $Li_{13}Cu_6Ga_{21}$ 144
of LiZnGe 149
of $Li_2ZnGe$ 150 f
of $Li_8Zn_2Ge_3$ 152
of $(Me_4N)V_4O_{10}$ 263 f
of $Mn_{14}Al_{56+x}Ge_{3-x}$ 186
of $(NMe_4)Cu_2Cl_3$ 271
of $Na_2Cs_3Cu_3(P_2O_7)_2Cl_3$ (CU-4) 244
of $NaEuGeSe_4$ 217
of $Na_8Eu_2(Si_2Se_6)_2$ 218
of $Na_8Ge_4Se_{10}$ 219
of $Na_5RbCu_4(AsO_4)_4Cl_2$ 248
of $Na_9Sm(Ge_2Se_6)_2$ 218
of $Na[(Zr_6B)I_{14}]$ and derivatives 67 f
of $PbLu_3Ti_2Nb_6Cl_{15}O_6$ 87
of $PrI_2$ 46 ff
of $R_5Tt_4$ (R = rare earth metal; Tt = Si, Ge) 189
of $Sr_3(BN_2)_2$ 127 f
of $SrCa_2In_2Ge$ 163
of $Ti_2Nb_6Cl_{14}O_4$ 90 f
of TlF, TlCl 21
of $[(Zr_6B)Cl_{13}]$ and derivatives 64 f
of $[(Zr_6C)I_{12}]$ and derivatives 63 f
cyclic voltammogram
of $Cu_{5.5}Si_{1.5}Fe_4Sn_{12}S_{32}$ 231
of $Li_9AlSi_3$ 148
of $Li_2ZnGe$ 148

***d***

decomposition
of $NaAlH_4$ 286
of TiN-doped $NaAlH_4$ 287
density functional theory (DFT) 95 f, 117
density of states (DOS) 21 ff
for B-N bonding states 130
for $Ba_2NiS_3$ 167
for $Ca_5In_9Sn_6$ 165
for $La_2Ca_3Ge_4$ 190
for $Li_2AlAg$ 145
for $Li_2ZnGe$ 151
for $Li_8Zn_2Ge_3$ 153
for $Mn_{14}Al_{56}Ge_3$ 187
for $SrCa_2In_2Ge$ 164
for TlCl 22
for TlF 22
density parameter 30
diad effect 11
dihalides
of Sm, Eu, Yb 1
of Nd, Dy, Tm 1
dimensional reduction 108
diphenylethyne, reduction with $NaAlH_4$ 289
DSC diagram of $PrI_2$ 56
DTA diagram of $La_3(B_3N_6)$ 132

***e***

electron counts 61
electron localization function (ELF) 106
electronic structure(s)
configuration 99 f
of transition metal clusters 84

***f***

Fermi level 21, 51
fluorescent decay profile
for $BaBPO_5$ 311
for $Ba_3BPO_7$ 311
for $Ba_3BP_3O_{12}$ 309 f
for $Ba_3BP_3O_{12}:Ce^{3+}$ 318
of $Ba_3BP_3O_{12}:Eu^{2+}$ 320 f
framework(s)
anionic 152

anisotropy 82
dimensions 81 ff

**g**
gadolinium sesquichloride ($Gd_2Cl_3$) 8

**h**
heterometallic perrhenates 252 f
heterometallic vanadates 259 f
host-guest chemistry 18, 118
Hückel parameters 17
Hume-Rothery phases 159
hybridization 17, 20
hybrid materials 239 ff, 251 ff
hydrogen bonding 267 ff
electronic implications 272 f

**i**
icosahedral symmetry 144
ionization enthalpies 3
inert electron pair 15 ff
interaction scheme 25
inter-electronic repulsion 1, 4, 10
intermetallics
electron-poor 161
geometric requirements 158
Ce-Ca-Ge 188 f
La-Ca-Ge 188 f
Li-Al-Ag 145
Li-Al-Si 146
Li-Zn-Ge 149
Mn-Al-Ge 184 f
polar 157 ff
$\pi$ systems 162 f

**k**
Kepler's conjecture 30
kissing number problem 30

**l**
lanthanide chemistry 1, 4
lanthanide metal clusters 8
lanthanum nitridoborates 131 f
structures of 134 f
lattice enthalpy 12
layered hybrid solids
perrhenates 251 ff
vanadates 251 ff
ligand
arrangement 94
combination strategy 79 ff
exchange reactions 112
field stabilization energy 12
liquid-liquid separation 9
lithium Zintl phases 141 ff
lone pair of electrons 15 ff
distortions 17
luminescence spectrum
of $BaBPO_5$ 312
of $Ba_3BPO_7$ 309 f
of $Ba_3BP_3O_{12}$ 308
of $BaBPO_5:Ce^{3+}$ 317
of $Ba_3BPO_7:Ce^{3+}$ 317
of $Ba_3BP_3O_{12}:Ce^{3+}$ 316
of $Ba_3BP_3O_{12}:Eu^{2+}$ 319

**m**
magnetic susceptibility
vs. temperature of $Cu_{5.5}Si\square_{1.5}Fe_4Sn_{12}S_{32}$ 231
vs. temperature of $EuIn_2P_2$ 179
vs. temperature of $Eu_3InP_3$ 179
vs. temperature of $Eu_3In_2P_4$ 179
magnetoresistance 174
vs. temperature of $EuIn_2P_2$ and $Eu_3In_2P_4$ 180
main-group elements 15
metal-metal bonding
in niobium chlorides 80
in trinuclear molybdenum and tungsten clusters 106
mixed-halide systems 61
Mössbauer spectrum
of $Cu_{5.47}Fe_{2.9}Sn_{13.1}S_{32}$ ($^{57}Fe$) 234
of $Cu_{5.47}Fe_{2.9}Sn_{13.1}S_{32}$ ($^{119}Sn$) 233
of $Cu_{5.5}Si\square_{1.5}Fe_4Sn_{12}S_{32}$ ($^{119}Sn$) 229
of $Cu_{5.5}Si\square_{1.5}Fe_4Sn_{12}S_{32}$ ($^{57}Fe$) 230
molecular conductors 115
molybdenum
trinuclear cluster chalcogenides 105 ff
morphologies of nanomaterials 296 f
control of 299 f

**n**
nanoparticles 279 ff
nanosized materials 295
nanosynthesis methods 295 f
[$NbAs_4$] tetrahedra 199 ff
neighbouring parameter 32
nephelauxetic effect 9
niobium
chlorides 83
oxide clusters 83
oxychlorides 85
nitridoborate anions 133
NMR spectrum

of $CaC_2$-II and -III 125
of high surface area TiN 284
non-centrosymmetric solids (NCS) 240

*o*
optical transmittance spectrum
of $BaBPO_5$ 313
orbital interaction diagram
for $NbAs_5^{6-}$ 201

*p*
pillared hybrids 256 f
phase diagram
of the system K/P/Eu 211
of the system K/P/La 211
of the system Pr/$PrI_3$ 48
polyhedral packing in $A_2RE(P_2S_6)_{1/2}(PS_4)$ 212
praseodymium di-iodide ($PrI_2$) 45 ff
phases 47 f
powder X-ray diffraction 52 ff
structures 48 ff
synthesis 47 f

*q*
quasicrystals 143

*r*
rare-earth element(s) 1
in Zintl phases 173 ff
chalcoantimonites 213 f
chalcoarsenites 213 f
chalcophosphates 210 ff
chalcotri- and tetrelates 215 f
rare-earth metal di-iodides 45 ff
metallic 45 f
salt-like 45 f
reduced zirconium halides 61
reduced rare-earth metal halides 46
relativistic effects 15 ff
repulsion, inter-electronic 1, 4, 10
resistivity
vs. temperature of $Cu_{5.5}Si\square\square_{1.5}$-$Fe_4Sn_{12}S_{32}$ 230
vs. temperature of $Eu_3InP_3$ and $Eu_3In_2P_4$ 177
vs. temperature of $Eu_2InP_2$ 178
RKKY theory 173, 196

*s*
salt-inclusion synthesis 239, 241 f
Samson polyhedron 143 f
scintillation materials 305 ff
$Ba_3BP_3O_{12}:Eu^{2+}$ 318
shell structure 15
solventless thermolysis 295 ff
s-p mixing 17
space filling 98
spin-pairing energy 9
spinel 225 ff
stability sequence 2
standard enthalpy 5
stereochemical activity 15 ff
structural units $M(H_2O)_x(ReO_4)_y$ 253
structure-directing forces 268
structure-forming factors 183
structure-property relationships 183
structures
of binary compounds 43
of elements 42
of the anions $\{[Mo_3S_7X_3]Br\}^{n-}$ 114
of the anion $[NbIn_3As_5]^{7-}$ 202
of the cations $[Mo_3S_4Cl_3(Me\text{-}BPE)_3]^+$ 111
of the dimers $[Nb_2As_6]$ 205
of $V_2O_5^{n-}$ layers
ideal 42
supramolecular adducts 117

*t*
TEM image(s)
of Ag nanocoins 301
of $Bi_2S_3$ nanowires 298
of $Cu_2S$ ribbons 297
of NiS nanocrystals 298
of $Pb_3O_2Cl_2$ nanobelts 299
tetrad effect 9
TG-DSC curve of $Ba_3BP_3O_{12}$ 321
thermoluminescence glow curve
of $BaBPO_5$ 315
titanium niobium oxychlorides 79 ff
titanium nitride (TiN) nanoparticles
catalytic properties 279 ff, 288 f
high surface area 281
in hydrogen storage applications 285 f
nitrogen physisorption isotherms 282
synthesis 280 f
transmission electron micrograph 283
thallium 15 ff
halides 21
theory-guided exploration 183
thiospinel(s)
cation-deficient quaternary 225 ff
typical structure 226
transformation of close-packing arrangements 35 ff