Book Review

Binary Rare Earth Oxides Edited by G. Adachi (Juri Institute for Environmental Science and Chemistry, Osaka), N. Imanaka (Osaka University), and Z. C. Kang (International Center for Quantum Structures and State Key Laboratory for Surface Sciences, Beijing). Kluwer Academic Publishers: Dordrecht, The Netherlands. 2004. xiv + 258 pp. $125.00. ISBN 1-4020-2568-8.

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J. Am. Chem. Soc., **2005**, 127 (21), 7961-7962• DOI: 10.1021/ja041010t • Publication Date (Web): 03 May 2005

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BOOK REVIEWS

Progress in Colloid and Polymer Science, Volume 128. Surface and Colloid Science. Edited by Fernando Galembeck (Universidade Estadual de Campinas, Brazil). Series edited by F. Kremer and W. Richtering. Springer: Berlin, Heidelberg, New York. 2004. x + 314 pp. $225.00. ISBN 3-540-21247-7.

This book contains 58 contributions from the 11th International Conference on Surface and Colloid Science held in Iguassu Falls, Brazil, in September 2003. The subject areas under which the chapters are grouped are as follows: Charged Particles and Interfaces; Interfaces and Adsorption; Nanostructures and Nanotechnology; Self-Assembly and Structured Fluids; Biocolloids and Biological Applications; Colloidal Dispersions; Surfactants and Polymers; Technology and Applications; Colloids and Surfaces in Oil Production; and Environmental Colloidal Science. An author/title and a keyword index complete the book, which is also available online.

JA059718A

10.1021/ja059718a

Spin Crossover in Transition Metal Compounds II. Topics in Current Chemistry, 234. Edited by Philipp Gütlich (Johannes Guternber-Universität, Mainz, Germany) and Harold A. Goodwin (University of New South Wales, Sydney, Australia). Springer-Verlag: Berlin, Heidelberg, New York. 2004. xiv + 294 pp. $259.00. ISBN 3-540-40396-5.

This is the second in a three-volume series on spin-crossover phenomena in transition metal compounds, and although this topic has been extensively reviewed in the past, this book represents a vital and up-to-date compendium of the field. Spin-crossover behavior, observed in transition metal compounds possessing d^4, d^5, d^6, and d^7 electron counts, derives from a discontinuity in the energies of ligand field states when the ratio Dq/B reaches a critical value. This results in the high-spin ground state converting to the low-spin state as Dq/B increases. Spin-crossover compounds are of particular chemical interest because they are inherently electronically labile, and the high- and low-spin states can be interconverted by external perturbations such as temperature, pressure, optical excitation into ligand field bands, and ligand photoisomerization reactions, among others. The observance of thermal and light-induced bistability has led to suggestions that spin-crossover systems may play a future role in molecular-based electronics, including two-color display devices and registers for storing information.

This volume devotes 10 chapters to the spin-crossover phenomena, beginning with a chapter on the origin of spin-state transitions in rare earth-transition metal perovskite oxides. Other chapters detail various aspects of Co(II), Mn(II), Mn(III), Cr(II), and Fe(II) spin-crossover compounds. There is a very nice chapter on valence tautomeric transition metal complexes that typically utilize dioxolene donors, or their Schiff-base variants, to facilitate a thermally induced intramolecular redox reaction utilizing the catecholato/semiquinonato couple. Most valence tautomeric complexes represent a unique example of the spin-crossover phenomenon because they are able to undergo a combined intramolecular electron transfer between the metal and ligand coupled to a high-spin to low-spin transition on the metal. The book closes with four chapters on various aspects of excited-state processes in spin-crossover complexes. These include two chapters on the light-induced excited spin-state trapping (LIESST) effect, a penultimate chapter on the related phenomena nuclear decay-induced excited spin-state trapping (NIESST), and a closing contribution on ligand photochemical reactions that can trigger reversible spin-state interconversions in transition metal systems. The last four chapters in the volume, coupled with the valence tautomerism chapter, will be of specific interest to those researchers already familiar with the basics of spin-crossover behavior and are interested in using these unique transition metal systems as key components in the design of new and complex photoaddressable, molecular-based materials.

In summary, this volume is representative of the typical quality found in the *Topics in Current Chemistry* series. It is expertly edited by two leaders in the field. The topics and order of the chapters in the three-volume set have been carefully selected and are, in general, well-written. All three volumes in the series are worthy of being added to the university library and should find an audience in fields ranging from bioinorganic to solid state chemistry. Active practitioners in the field will certainly want all three volumes of the series for their shelves. My only concern is the cost per volume. Many university libraries, continually looking for ways to reduce expenditures, may find the total cost of all three volumes prohibitive.

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JA040990E

10.1021/ja040990e

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The science and technology of rare earth oxides is a diverse and content-rich field, ranging from well-established ceria-based catalysts to the more recent use of rare earth-doped oxide materials for memory storage and high k dielectric transistor gates. The authors of this volume attempt to provide a useful compilation of the structure, reactivity, and technologically useful properties of binary combinations of these elements.

A number of topics are discussed in requisite detail and with clarity. The chapter concerning reactivity—in reality a discussion

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10.1021/ja059718a CCC: $30.25

of the phase behavior and thermochemistry of aquo and carbonate variants—is thoroughly done. It correlates well with the chapter that follows regarding common crystal structures. Amply interpreted images of high-resolution transmission electron micrographs and selected area electron diffraction patterns are also included. The real gems of this book, however, are the succinct chapters outlining the physical and chemical properties of these oxides and highlighting some of the more recent applications that rely intimately on the key actions of rare earth oxides in their performance, e.g., not only as catalysts and phosphors, but as fuel cells and biomaterials as well. Given the increasing popularity of nano- and microsized oxide particles of these oxides, the up-to-date description of synthetic preparative methods in a separate chapter is useful.

The treatment of the assigned topics of this book is not always even, however. A chapter in which the aim is to offer insights into the bonding and orbital interactions in this class of solids is of limited utility, and much of a potentially useful chapter regarding analytical methods of the trace determination of rare earths focuses on commonly known summaries of instrumental methods. For this particular subtopic, the accompanying table listing case histories of rare earth ion analyses is of far greater merit for the reader who wishes to find further information.

Overall, this is a useful book not only to those working in the area of rare earth oxides, but also to the solid-state scientist seeking to expand his or her knowledge of some of the important details associated with this technologically relevant class of solids.

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JA041010T

10.1021/ja041010t