

ately, insulating oxides, in which correlation effects induce a breakdown of the effective one-electron picture. Chapters 2 and 3 provide a general description of the atomic and electronic structure of the uppermost layer of the surface with particular emphasis on relaxation processes. The aspect of non-stoichiometric reconstruction and influence of non-stoichiometry on the electronic structure, which are important for the oxides and constitute a very active field of current research, are, unfortunately, touched on only in passing. In the fourth chapter, Noguera investigates the excitations associated with the atomic and electronic degrees of freedom of the surface. In the last two chapters, she applies and extends some of the fundamental principles established in the first chapters to specific problems related to the metal-oxide interface and adsorption, which are both of interest for technological applications.

The efforts of the author to analyze and describe the broad spectrum of phenomena of oxide surfaces as well as her interdisciplinary approach are highly appreciated and very welcome. Also, the bibliography makes the book handy as an introductory guide to the field. A wide spectrum of literature has been invoked to analyze the trends, with emphasis on the idealized surface of model substances to provide the basis for an application of standard theoretical analysis. The clear line of argument and rigorous conceptual framework for the interpretation of the atomic and electronic structure of oxide surfaces are well suited to the didactic aim of the book. Her effort to provide a condensed description characterizes the quality of the book but highlights also the controversial aspect of her endeavor. The generalization that is presented suggests, for example, that binary and ternary oxides are only slightly different with regard to their geometrical factors within the upper layers of the crystals or that the non-stoichiometry has little influence on the electronic structure. Yet, it is well known for the binary oxides, and applies probably similarly to ternary oxides, that the structural composition in the surface region and the complexity of phenomena of non-stoichiometry have to be included in a full analysis of the real surfaces. Also, ferroelectric materials, which have been neglected but constitute a very important class of ternary oxides, show a completely different behavior concerning the screening properties and domain structure.

We can highly recommend the book as an accompaniment to introductory courses

on oxide surfaces for graduate students in solid-state physics and chemistry.

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Science of Fullerenes and Carbon Nanotubes. By M. S. Dresselhaus, G. Dresselhaus, and P. C. Eklund, xviii, 965 pp., Academic Press, San Diego, CA 1996, hardcover, ISBN 0-12-221820-5.

The discovery of fullerenes, the third form of ordered carbon after diamond and graphite, and the subsequent discovery of a plethora of other nanostructures of carbon, has led to a significant amount of interest in the research, properties, and potential applications of these materials.



SCIENCE OF FULLERNESS

From this perspective, this book on fullerenes and nanotubes is extremely timely. It conveys information on the myriad forms of known carbon such as graphite, diamond, glassy carbon, carbon blacks, structural carbon materials such as fibers and whiskers, and nanocarbons such as fullerenes and nanotubes; it also lays a very effective groundwork for the structural, physical, and chemical inter-relations between these various forms. The book is extremely well written and descriptive, and provides the layman who is conversant with the physical and chemical sciences with a unique opportunity to obtain a comprehensive understanding of carbon and fullerene science.

This book comprises 20 chapters, and includes a total of over 2000 cited references, which is a direct result of the ex-

citement that these novel forms of carbon have generated in the research community world-wide. The authors have done a remarkable job of compiling these references into well organized chapters that allow the reader to develop a very comprehensive knowledge of fullerenes. From the historic developments to analogies with naturally existing biological and geological materials, in the early part of the book the authors lay a solid foundation on fullerenes and related materials that takes away the element of intimidation most readers of science encounter when dealing with the physics and chemistry of any novel material.

Chapters 1 and 2 provide an overview of various forms of carbon. Chapters 3–9 offer significant insights into the processing and structure of fullerenes and doped (endohedral, substitutional, and exohedral) fullerenes. The chemical and physical properties of fullerenes are exhaustively described in Chapters 10–18. No fullerene book is complete without reference to the wide array of nanoparticles spawned by the fullerene-making process of vaporization and condensation of carbon in an arc-discharge process. These are particles such as multi- and single-walled carbon nanotubes, carbon nano-onions, or carbon-encapsulated metal nanoparticles, and Chapter 19 does justice to the claim made in the previous sentence. In fact, there is a strong sentiment in the fullerene research community that the discovery of carbon nanotubes may actually be more significant than that of the conventional fullerenes — single-walled carbon nanotubes are potentially the strongest material produced with electrical conductivity similar to metals, with potential for significant commercial applications. The final chapter outlines some of the potential applications that may come about as a result of the continuing research on these materials.

The authors' liberal use of micrographs and illustrations helps the reader to easily follow the arguments presented. In summary, this book consists of an up-to-date and extremely well-documented compilation of insights into a set of novel materials with exciting chemical and physical properties and potentially exciting applications. It will certainly be of significant value to any chemist, physicist, or materials scientist.

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