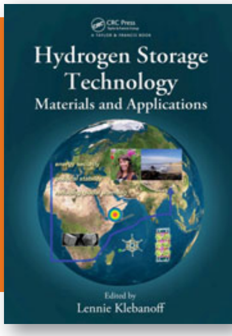


Hydrogen Storage Technology: Materials and Applications

Editor: Lennie Klebanoff

CRC Press, 2013
455 pages, $169.95
ISBN: 978-1-4398-4107-5

It is an often heard statement that hydrogen is the fuel of the future; some people add, "and will always be." Why is the first element in the periodic table so important to our future? Its combustion produces energy with no release of CO_2, since it does not contain carbon. Its use in fuel cells does not emit NO_x. It can be produced from water, which is available widely and more abundantly than fossil fuels. How do we make its generation, storage, and distribution affordable? These precisely are the issues discussed comprehensively in the 12 chapters of this book.

In Section I, Klebanoff and co-authors provide two introductory articles for a general audience. They discuss the need for hydrogen-based energy technologies, hydrogen conversion devices, and automotive applications, including a very readable introduction to fuel cells. Section II offers six articles devoted to hydrogen storage materials with an emphasis on solid-state storage. Materials science, physics, and engineering aspects are dealt with fully. Section III, containing four articles, takes the engineering approach in discussing storage materials, refueling, codes, and standards.

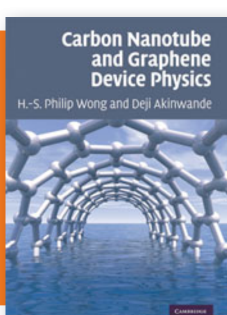
Many of the contributors in this multi-author volume participated in three hydrogen storage centers of excellence set up by the US Department of Energy, which accounts for the uniformity of style and quality in this book. Contributions come from four countries: the United States, Canada, China, and the United Kingdom, reflecting international concerns. The book as a whole will be a good reference in a graduate level course on energy systems and will also be useful to scientists and engineers in fundamental and industrial research. Policymakers will especially be interested in Section I.

The publication of this book is timely. Materials tend to be closer to commercialization when they have more than one application. Metal hydrides, for example, originally developed for hydrogen storage, and discussed in depth in Chapters 5 and 6, are now used in concentrating solar power plants to store power produced from intermittent solar radiation. New catalysts are being discovered for generating hydrogen from water using sunlight: porous silicon with pore size 8–15 nm; nontoxic, cheap, and abundant materials like tin oxides for water-splitting reactions using visible light; and cobalt-containing molecules grafted to semiconductors and subnanometer gold clusters, to name a few.

Recently, it was found that a combination of aluminum oxide, water, and olivine subjected to 2 kbar pressure at 200–300°C liberates hydrogen from water while the remaining oxygen converts olivine to serpentine. Automobile companies are turning to hydrogen in order to meet the exacting standards for emissions and fuel economy.

The future is closer than we think.

Reviewer: N. Balasubramanian *is a consultant in Bangalore, India, working on materials for energy generation and for storage and materials genomics.*



Carbon Nanotube and Graphene Device Physics

H.-S. Philip Wong and Deji Akinwande

Cambridge University Press, 2011
251 pages, $ 92.00
ISBN 978-0-521-51905-2

This book is based on a graduate level course at Stanford University, which characterizes the whole book. Each chapter begins with a very short elementary introduction to the topic, although the level of abstraction increases immediately. The interested reader requires some knowledge of modern solid-state physics; a reader without an appropriate background in science would be thankful for a more extended introduction. However, it is an important advantage of this book that the authors use mathematical notation commonly used among engineers. Furthermore, each chapter ends with a set of problems. This is important for readers to check their progress in understanding the topics. However, it would have been helpful if the answers were also provided.

The coverage of the topics is comprehensive. The book starts with an overview of carbon nanotubes and graphene with respect to their structure. Importantly, the concept of chirality for nanotubes is explained in detail. This is often neglected because it does not generally exist in crystallography. After an excellent introduction to electrons in a solid, the electronic states of graphene and carbon nanotubes are described. On the basis of this knowledge, electrical conductivity of these materials is

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