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Energy Storage



Synopsis

Introduction Energy is necessary for a number of reasons, the most basic and obvious involve the preparation of food and the provision of heat to make life comfortable, or at least, bearable. Subsequently, a wide range of technological uses of energy have emerged and been developed, so that the availability of energy has become a central issue in society. The easiest way to acquire useful energy is to simply find it as wood or a hydrocarbon fossil fuel in nature. But it has often been found to be advantageous to convert what is simply available in nature into more useful forms, and the processing and conversion of raw materials, especially petrochemicals have become a very large industry. Wood has been used to provide heat for a great many years. In some cases, it can be acquired as needed by foraging, or cutting, followed by simple collection. When it is abundant there is relatively little need for it to be stored. However, many societies have found it desirable to collect more wood than is immediately needed during warm periods during the year, and to store it up for use in the winter, when the needs are greater, or its collection is not so convenient. One can still see this in some locations, such as the more remote communities in the Alps, for example. One might think of this as the oldest and simplest example of energy storage.

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Customer Reviews

Aus den Rezensionen: "Es schließen sich 22 Kapitel mit theoretischen Grundlagen und verschiedenen Energiespeichermöglichkeiten an. ... das Buch sehr schon die reversible Interkalation hilft dem Leser dabei, die verschiedenen Konzepte ... zu verstehen."

... Das lehrreiche und didaktisch gut gemachte Buch bietet einen umfassenden Überblick über die physikalischen, elektrochemischen und strukturellen Prinzipien ... wendet sich gleichermaßen an Studenten Doktoranden wie an Hochschul und Industrewissenschaftler. ... Zielt auf Grundlagenverständnis und eignet sich zum Selbststudium oder auch als Nachschlagewerk (Thomas Wohrle, in: Nachrichten aus der Chemie, April/2011, Vol. 59, Issue 04, S. 469)

Energy Storage discusses the underlying fundamentals of all the major energy storage methods. These include the storage of energy as heat, in phase transitions and reversible chemical reactions, and in organic fuels and hydrogen, an important energy carrier. The principles involved in the storage of energy in mechanical, electrostatic and magnetic systems are also treated in some detail. Major attention is given to an up-to-date discussion of electrochemical storage systems in a way that does not require prior understanding of electrochemistry. This includes both traditional battery systems and recent developments, with special attention given to the very important, and rapidly evolving, lithium batteries. Energy Storage provides a comprehensive overview of the concepts, principles and practice of energy storage that will be useful to both students and researchers.

This book provides an excellent overview of the various methods that can be used for energy storage. Topics include the storage of heat by use of phase change materials, reversible chemical reactions, and in a variety of organic fuels, not just oil. A number of ways to store mechanical energy, both as potential energy and as kinetic energy, are described, including the obvious pumped water and flywheels. Energy storage in the different types of capacitors, magnetic and superconductive systems are also discussed. There is an unusually broad discussion of the various methods for the production and storage of hydrogen. More than half of the pages are dedicated to the storage of energy in electrochemical systems. That is where this book stands out from all the rest. Rather than merely describing the different types of batteries, it teaches the materials science principles that determine the voltages and capacities of electrochemical systems and devices, and their kinetic properties. Topics cover the whole spectrum, from heart pacemaker power sources to the common non-rechargeable alkaline cells, metal hydride cells, lithium-ion batteries, and the flow batteries that will surely play an important role in connecting intermittent sources, such as wind and solar, to the large scale electrical grid. The discussion of the common lead-acid battery shows, for the first time, why these water-based electrochemical cells can have voltages that are well beyond what would normally cause water to be decomposed into hydrogen and oxygen. This book is really

an outstanding textbook, for topics are discussed in a manner that teaches the important principles involved, rather than being merely descriptive.

This book does a decent overall view of the field of renewable energy. Although poorly written in some places it covers all the areas required for a graduate/undergrad class.

This book is very good for an introductory course of Energy Storage. With a focus on battery and capacitor devices. Very little information on other systems.

"Energy Storage" by Robert A. Huggins covers an amazingly broad range of energy-storage methods, relevant to storage on many size scales, ranging from small-scale storage--button cells for small items, medium-scale for small tools--to industrial-scale storage for utility applications. The book is very comprehensive, covering energy-storage media from primitive resources like wood to advanced batteries, and describing means of storing energy over many time scales, from seconds to years. The need for a new look at energy storage is clear, as world population and increasing energy demand strain existing energy resources. An example of the need for alternative energy resources which require large-scale energy storage is the developing field of renewable energy sources: solar and wind energy. These resources will greatly increase in value as their intermittent energy production can be matched to efficient energy storage, thus allowing coupling of production and energy storage with demand, for which time-shifting is often necessary, as the sun does not always shine and the wind does not always blow, especially at times of peak energy demand. The book emphasizes materials-science aspects of energy storage, and uses aspects of thermodynamics and electrochemistry in its analyses. Advanced students, scientists, and engineers will find this outstanding book highly useful and a valuable resource to have available. I highly recommend it to other readers who share my interest in energy storage.

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