

Preface

This book provides both the theoretical background and state-of-the-art review of solar-to-chemical energy conversion: the most important technology for energy storage, which is vital for sustainable human life in the future. The theoretical background starts with the concept of chemical potential and equilibrium in a molecular system and solid-state system, especially semiconductor. All chemical reactions, including the reactions at the interface between an electrolyte and a semiconductor (and/or metal) surface, are driven by the extent of nonequilibrium, or the difference in chemical potential, as described in the text. On such theoretical basis, a variety of technologies for solar-to-chemical energy conversion are discussed. Chemical, electrochemical and photoelectrochemical approaches are described for converting solar energy into hydrogen or other hydrocarbon species as energy storage media. Photosynthesis is the most sophisticated system of solar-to-chemical energy conversion developed by nature. Its up-to-date understanding and the way to implement its mechanism in an energy-efficient manner are discussed, including the use of algae for engineered photosynthesis. The broad-spectrum description in this book will provide a basis for the research and development of chemical energy storage in the coming decades.

Solar to Chemical Energy Conversion

Theory and Application

Sugiyama, M.; Fujii, K.; Nakamura, S. (Eds.)

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