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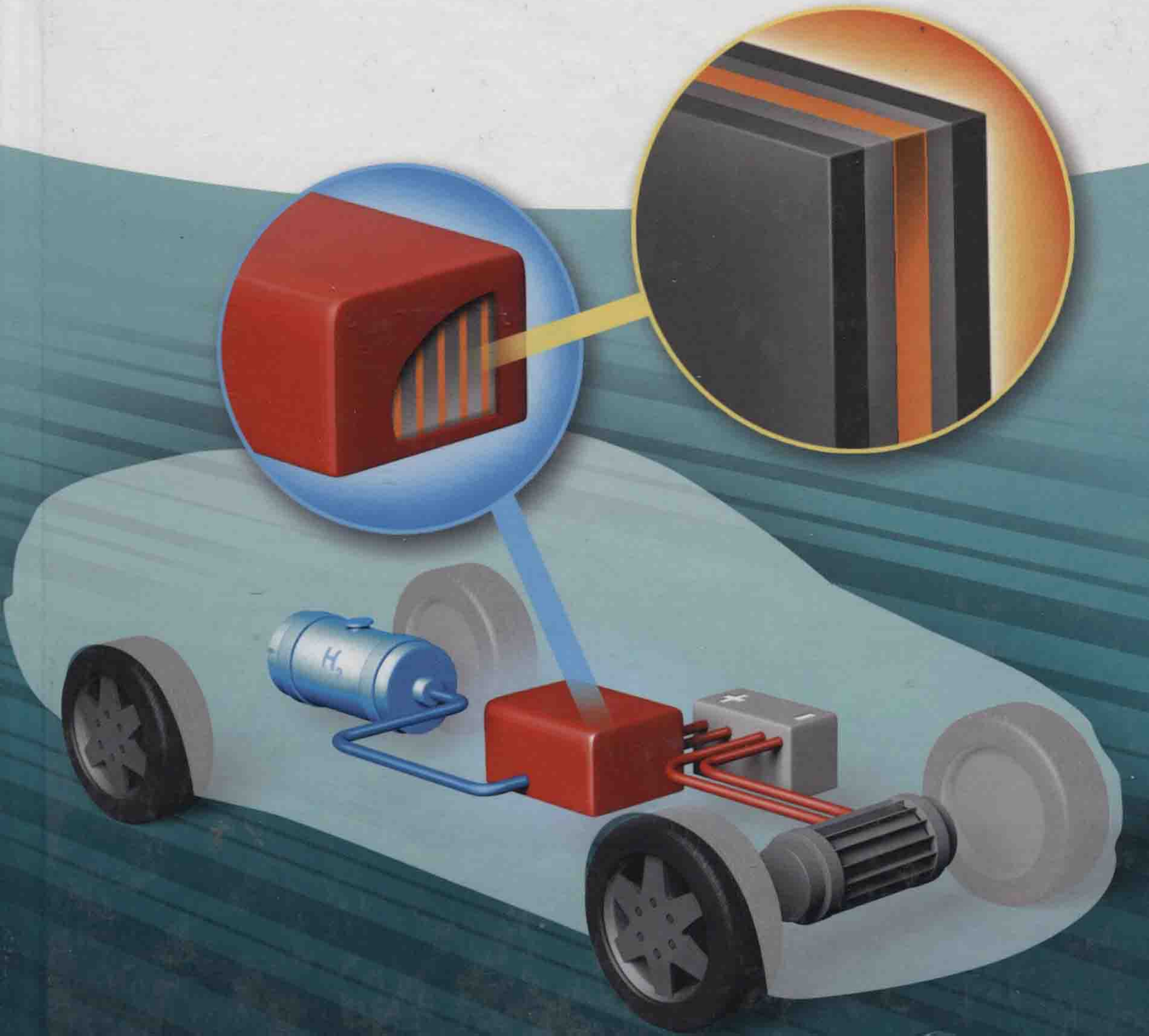
Edited by Zhongwei Chen, Jean-Pol Dodelet, and Jiujun Zhang

Non-Noble Metal Fuel Cell Catalysts



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Preface

In the context of economic development and improvement in human living conditions, developing advanced technologies for energy storage and conversion has become a hot topic today. Polymer electrolyte membrane (PEM) fuel cells are one kind of important clean energy-converting devices that have drawn a great deal of attention in recent years due to their high efficiency, high energy density, and low or zero emissions, as well as their several important areas of application such as transportation, stationary and portable power, and micro-power. However, two major technical challenges, namely, high cost and low reliability/durability, have been identified as the major obstacles hindering the commercialization of PEM fuel cells. Fuel cell catalysts, such as platinum (Pt)-based catalysts and their associated catalyst layers, are the major factors related to these challenges. To overcome the challenges, exploring new catalysts, improving catalyst activity and stability/durability, and reducing catalyst cost are currently the major approaches in fuel cell technology and commercialization.

Regarding the cost reduction of Pt-based catalysts, non-noble metal catalysts, the next generation PEM fuel cell catalysts slated to replace expensive Pt, have been recognized as the sustainable solution for the commercialization of PEM fuel cells. In more recent years, intensified research and development in this area has been carried out by the world fuel cell community. To facilitate this effort, a book specifically focusing on this area is definitely necessary. This book contains comprehensive and systematic information on non-noble metal electrocatalysts for oxygen reduction reactions in both acid and alkaline PEM fuel cells with emphasis on (i) the fundamentals of electrochemical oxygen reduction catalysis with non-noble metal catalysts within acid and alkaline PEM fuel cells; (ii) the synthesis, characterization, activity validation, and modeling of various kinds of non-noble metal electrocatalysts; and (iii) the integration of the non-noble metal electrocatalysts into fuel cells and validation of their performance.

This book is written by a group of top scientists in the field of fuel cell catalysts, who not only have excellent academic records but also industrial expertise in the use of fuel cells. The book contains the latest updated information on R&D achievements and understanding in electrocatalysts for oxygen reduction reactions in both acid and alkaline PEM fuel cells. Some important R&D directions toward commercialization of both types of fuel cells are also discussed. In order to help readers understand the science and technology of the fuel cell catalysis, some important and representative figures, tables, photographs, and a comprehensive list of reference papers are presented in this book.

We believe that this book should be extremely useful to researchers and engineers who are working in energy/fuel cell industries. We sincerely hope that through reading this book, the reader will easily be able to locate the latest information on the fundamentals and applications of the catalysis of the oxygen reduction reaction in the next generation of fuel cells. It is expected that this book could be used as a reference for college/university students including undergraduates and graduates, and scientists and engineers who work in the areas of energy, electrochemistry science/technology, fuel cells, and electrocatalysis.

We would like to acknowledge with deep appreciation all of the efforts of all the contributors in writing their chapters. We also wish to thank Dr. Heike Nöthe, Senior Project Editor at STMS Books for extensive help and support.

If technical errors are found in this book, we and all the contributors would deeply appreciate the readers' constructive comments for correction and further improvement.

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