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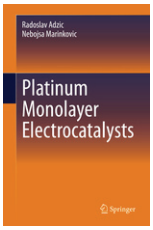
BOOK REVIEW

# Platinum Monolayer Electrocatalysis

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At first glance, this book captures attention with its splendid, dominantly orange colored hardcover. Within a volume of 167 pages, the reader encounters 11 chapters bearing the following titles: 1. Short Introduction to the Science of Electrocatalysis, 2. Electrocatalytic reactions, 3. Electrochemical Energy Conversion in Fuel Cells, 4. Studies of Electrocatalytic Reactions, 5. Important Electrosorption Reactions, 6. Important Electrocatalytic Reactions, 7. Platinum Monolayer Electrocatalysts, 8. Catalytic Properties of Pt Monolayer Electrocatalysts, 9. Performance Stability and Scale-Up Syntheses of Pt Monolayer Electrocatalysts, and, 11. Prospects for Platinum and Platinum Group Metal Monolayer Electrocatalysts.

One deals here with a scientific monograph based primarily on the authors personal research achievements. After a short introduction to the electrocatalysis, covering four reactions important for energy conversion in fuel cells in the first four chapters, in the fifth one the authors describe the properties of metal monolayers on electrode surfaces and underpotential deposition of metals.The period covered by this chapter begins with the Adžićs famous discovery of huge enhancement of electrocatalytic effectivenes of Pt surfaces upon adsorption of metal (Pb, Bi) submonolayers in 1970s. The main part of the book covers the descript-

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ion of very concept of Pt monolayer electrocatalysts, the ways of their synthesis and application. Through the description of numerous technically demanding investigations of four main reactions in energy conversion processes: oxygen reduction reaction and oxidation reactions of hydrogen, methanol and ethanol reactions on single-crystal surfaces, the book matter continues up to the recent application oriented systems. They involve stable, long-living core-shell structured electrocatalyst with durable, frugal Pt monolayers covering the cores of more abundant metals (Au, Pd and their alloys, and non-noble metals and alloys). In the concluding chapter the authors comment the predictions in scale-up syntheses and catalysts' stability in practical use.

What one might say about the temporary circumstances in which this book appeared?

The investigation of room-temperature fuel cells, the main subject of the book, experienced sudden acceleration after famous world oil crisis in 1970s. Since then, the developed countries funded many projects dedicated to the replacement of liquid fossil fuels in trafic by chemical sources of electric energy. With the oil market stabilization, this tension declined, however, in the period 1990–2000 a new threat splashed the world: climate changes caused by huge consumption of fossil fuels, which actualised the activities oriented to the development of new chemical power sources. Platinum seemed to be unavoidable electrocatalyst providing satisfactory effectiveness of fuel cells. In 2010s, an ambitious worlds action, supporeted by relevant UN bodies, to replace gradually all oil-driven automobile engines by electrically powered ones, seemed to be unattainable due to the too high demand of platinum in comparison to available Earth crust resources. This is the reason why automobile companies started to use Li-ion batteries rather than fuel cells, and a majority of both research grants and research institutions reoriented themselves toward the development of batteries. However, the authors of this book persisted in their research orientation, what resulted in many valuable new contributions in saving platinum as fuel cell electrocatalyst. This proved onself as reasonable performance, since metal resources required for Li-ion batteries became also critical, susceptible to rapid exhaustion in the next few decades. This new threat is the reason why the search for advanced fuel cell electrocatalysts is under permanent progress.

As the Springer's editor said, "Platinum monolayer electrocatalysts present a groundbreaking discovery that will likely have impact on future electrocatalysis. Unlike non-noble metal monolayer, platinum monolayer can have great stability and activity that can overcome three major obstacles of conventional platinum electrocatalysts – catalysts' cost, activity, and stability for a broad range of fuel cell applications." This is a reason why important automobile producers persisted in the development of fuel cells-driven automobiles. On dispasal stands the Platinum monolayer electrocatalyst developed by the authors of this book, produced

by N.E. ChemCat Corporation in Japan. It is licensed to two other companies. An actual difficulty for broader use of fuel cell powered automobiles, compared to battery driven ones, is the technically unsolved hydrogen distribution network, however this may be considered only as temporary obstacle.

This book may be highly recommended as an useful theoretical and practical guide to graduate, especially PhD students, preparing themselves for studies in surface science and electrocatalysis. Furthermore, reading this book, the researchers active in development of fuel cells will face the most recent research techniques available in worlds leading research institutions. Thanks to a selected literature surveys placed at the end of each chapter, the reader may follow a chronological development of fundamental concepts and practical aspect of functioning of electrocatalysts for contemporary room temperature fuel cells. Particularly, numerous practical examples illustrated by coloured graphs, discussed in a comprehensive language, offers a plenty part of knowledge presented in a concise and clear manner, as, otherwise, is really expected from the authors deeply personally involved in the subject matter of the book. I really enjoyed reading it.