Preface

The present volume of Modern Aspects of Electrochemistry is the second in a two-volume set (No. 46 and 47) that covers important technological progress in recent years in the fields of electrochemical corrosion and materials engineering.

The first chapter, by Macdonald, discusses electrochemical and corrosion phenomena of metals and alloys in supercritical aqueous media. The author reviews the corrosiveness of supercritical water oxidation (SCWO) media operating at temperatures up to 650 ^{o}C and at pressures of several hundred bars and the technical issues that need to be resolved for practical use of SCWO technology. The topics include the development of *in-situ* sensors for measuring pH and redox potential and the electrochemical polarization and corrosion studies in SCWO media.

In Chapter 2, Ohtsuka provides an *in-situ* characterization study of passive oxide films on iron and steels using optical techniques. A wide range of optical techniques – including ellipsometry, Raman spectroscopy, potential modulation reflectance and photo-electrochemical technique - are rigorously discussed to make a step further towards understanding what really happens during the passivation process. A comprehensive description is given of the growth mechanism, composition, and semiconducting properties (e.g., energy band gap, flat band potential, donor density, etc.) of the passive oxide films.

Chapter 3, by Oltra and Vuillemin, deals with experimental characterization and theoretical simulation of galvanic coupling phenomena in localized corrosion. The chapter offers a succinct, easy-to-follow introduction to the mathematical formulation of electrochemical reactions problems, followed by extensive coverage of localized galvanic corrosion modeling. The authors present several examples for galvanic corrosion on galvanized steel and aluminum alloys, which indicate the crucial role of current/potential distribution and homogeneous/heterogeneous chemical processes in localized corrosion.

In Chapter 4, Shin and Liu review some recent developments in fabrication of hierarchical 3-dimensional porous structures for energy storage and conversion by an electrochemical deposition process, an area in which electrochemistry and materials science are intertwined. These authors briefly present typical porous structures observed in materials for electrochemical devices, and then discuss the preparation of 3-dimensional electro-deposits with micro-/nano-hierarchical pores that could make the transport of electro-active species easier.

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