Preface

This volume contains four chapters. The topics covered are solid state electrochemistry devices and techniques; nanoporous carbon and its electrochemical application to electrode materials for super-capacitors; the analysis of variance and covariance in electro-chemical science and engineering; and the last chapter presents the use of graphs in electrochemical reaction networks.

Chapter 1 by Joachim Maier continues the solid state electrochemistry discussion that he began in Volume 39 of the Modern Aspects of Electrochemistry. He begins by introducing the reader to the major electrochemical parameters needed for the treatment of electrochemical cells. In section 2 he discusses various sensors: electrochemical (composition), bulk conductivity, surface conductivity, galvanic. He also discusses electrochemical energy storage and conversion devices such as fuel cells.

Gyoung-Ja Lee and Su-Il Pyun in chapter two review the synthesis and characterization of nanoporous carbons and their electrochemical application to electrode material for super-capacitors in relationship to the key role nanoporous carbons have played, for example, in the purification of liquids and carbons, catalytic reaction, and the storage of energy. Activation and templating methods are discussed in section II. They survey the structural characteristics of the porous carbons by the use the gas adsorption method in Section III. Section IV discusses the molecular probe method and the image analysis method for quantitative characterization of the pore surface irregularity and the size distribution irregularity based on the fractal theory. The investigation of the electrochemical performance of the porous electrodes for electric double layer capacitors considering the effects of geometric heterogeneity and surface inhomogeneity on kinetics of double-layer charging/discharging occurs in section V.

Joseph D. Fehribach reviews and discusses in Chapter 3 the uses of graphs in the study of chemical reaction network, particularly electrochemical reaction networks for electrochemical systems. He defines any graph used to study a reaction network as a reaction graph. He mentions three categories that cover the uses

of graphs: (1) reaction species graphs, (2) reaction mechanism graphs, and (3) reaction route graphs.

Keith Scott and Yan-Ping Sun review and discuss three dimensional electrode structures and mathematical models of three dimensional electrode structures in chapter four. Conductivity limitations of these three-dimensional electrodes can cause the current overpotential to be non-uniform in structure. Adomian's Decomposition Method is used to solve model equations and approximate analytical models are obtained. The first three to seven terms of the series in terms of the nonlinearities of the model are generally sufficient to meet the accuracy required in engineering applications.

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