1. Record Nr. UNINA9910810255303321

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Titolo	Impedance spectroscopy : applications to electrochemical and dielectric phenomena / / Vadim F. Lvovich
Pubbl/distr/stampa	Hoboken, N.J., : Wiley, c2012
ISBN	1-62198-219-X 1-280-88135-6 9786613722669 1-118-16409-1 1-118-16407-5 1-118-16410-5
Edizione	[1st ed.]
Descrizione fisica	1 online resource (370 p.)
Classificazione	SCI013050
Disciplina	543/.4
Soggetti	Impedance spectroscopy Electrochemistry
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Impedance Spectroscopy: Applications to Electrochemical and Dielectric Phenomena; Contents; Preface; 1. Fundamentals of electrochemical impedance spectroscopy; 1.1. Concept of complex impedance; 1.2. Complex dielectric, modulus, and impedance data representations; 1.3. Electrochemical experiment: charge and material transport; 1.4. Fundamental ambiguity of impedance spectroscopy analysis; 2. Graphical representation of impedance spectroscopy data; 2.1. Nyquist and Bode representation of complex impedance data for ideal electrical circuits; 2.2. Dielectric data representation 3. Equivalent-circuit elements and modeling of the impedance phenomenon3.1. Ideal circuit elements; 3.2. Nonideal circuit elements; 3.3. Circuit models for systems with two and more time constants; 4. Examples of ideal equivalent circuit models; 4.1. Basic R-C circuit; 4.2. Basic R|C circuit; 4.3 Randies RSOL- RCT\CDL circuit; 4.4. Debye dielectric relaxation (R1-C1)\C circuit; 5. Impedance representation of bulk-material and electrode processes; 5.1. Uncompensated impedance ZOHM; 5.2. Bulk-media impedance-RSOL, RBULK and CBUKL; 5.3.

Electrochemical double-layer capacitance CDL
5.4. Electrochemical charge-transfer resistance RCT5.5. Electrochemical sorption impedance ZSORP; 5.6. Mass-transport impedance; 5.7. Mixed charge-transfer, homogeneous, and diffusion-controlled kinetics; 6. Distributed impedance models; 6.1. Distributed RBULK |CBULK - R|NT|CPEDL circuit model; 6.2. General impedance models for distributed electrode processes; 6.3. Identification of frequency ranges for conductivity and permittivity measurements; 7. Impedance analysis of complex systems; 7.1. Dielectric analysis of highly resistive composite materials with particle conduction
7.2. Dielectric analysis of ionic colloidal suspensions7.3. AC electrokinetics and dielectrophoretic spectroscopy of colloidal suspensions; 7.4. Specific adsorption and multistep heterogeneous kinetics; 7.5. Impedance kinetics studies on porous electrodes; 8. Impedance Instrumentation, testing, and data validation; 8.1. Impedance test equipment; 8.2. Single-sine impedance equipment-lock-in amplifier and frequency-response analyzer; 8.3. Multiple-sine impedance equipment; 8.4. Electrochemical cells; 8.5. Linearity, causality, stability, consistency, and error analysis of impedance measurements
8.6. Complex nonlinear least-squares regression fitting8.7. Practical approach to experimental impedance data collection and analysis; 9. Selected examples of impedance-analysis applications: electroactive polymer films; 9.1. The field of electroactive polymers; 9.2. Impedance analysis of electrochemically active polymer films; 9.3. EIS models of conducting polymer films; 9.4. The future of electroactive polymers; 10. Selected examples of EIS analysis applications: industrial colloids and lubricants; 10.1. The field of industrial colloids and lubricants
10.2. Physical and chemical properties of lubricants

Sommario/riassunto

"This book presents a balance of theoretical considerations and practical problem solving of electrochemical impedance spectroscopy. This book incorporates the results of the last two decades of research on the theories and applications of impedance spectroscopy, including more detailed reviews of the impedance methods applications in industrial colloids, biomedical sensors and devices, and supercapacitive polymeric films. The book covers all of the topics needed to help readers quickly grasp how to apply their knowledge of impedance spectroscopy methods to their own research problems. It also helps the reader identify whether impedance spectroscopy may be an appropriate method for their particular research problem. This includes understanding how to correctly make impedance measurements, interpret the results, compare results with expected previously published results form similar chemical systems, and use correct mathematical formulas to verify the accuracy of the data. Unique features of the book include theoretical considerations for dealing with modeling, equivalent circuits, and equations in the complex domain, review of impedance instrumentation, best measurement methods for particular systems and alerts to potential sources of errors, equations and circuit diagrams for the most widely used impedance models and applications, figures depicting impedance spectra of typical materials and devices, extensive references to the scientific literature for more information on particular topics and current research, and a review of related techniques and impedance spectroscopy modifications"--