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Book reviews

Charge Transfer in Chemical Reaction Kinetics
by A. M. Kuznetsov (Cahiers de Chimie, Presses Polytechniques et Universitaires Romandes, Lausanne, 1997) SWF4690 ISBN 2 88074 320 6 + 107 pp

The aim of this little book is made clear in the preface 'to give a presentation of the main principles of the theoretical treatment of the chemical reactions of charge transfer in polar media in a clear and simple form'. It is based on a lecture course given by Professor Kuznetsov at the École Polytechnique Fédéral de Lausanne and is successful in reaching this stated goal. Although by no means non-mathematical, the treatment is characterized by an emphasis on physical meaning. This is often achieved by the use of well-chosen analogies, frequently accompanied by clear diagrams.

The initial chapter is a brief summary of the types of charge transfer reaction in condensed phases which are discussed on the frame of the theories outlined later in the book. Apart from a mention (p. 70) of the systems in which the inverted region has been observed, this is the only contact with experiment. It is clear that, in the context of a short book, one cannot expect a detailed exposition of the verification of the theoretical predictions; but this does lead to a feeling that the sophistication of the models is not matched by its power to explain experiments. Perhaps it would have been wise to include the word 'Theory' in the title of the book to warn the reader.

Chapter 2 lays the general foundations for the quantum mechanical treatment of electron transfer reactions and Chapter 3 applies these to the transfer of an electron transfer between two particles immersed in a polar solvent. The subsequent brief chapters deal with electron transfer between an electrode and a reactant in solution, proton transfer, the isotope effect, and, finally, the stochastic approach. This last topic is criticized in that it differs from the approach in of the main part of the book only in the pre-exponential factor (for adiabatic reactions). A similar criticism of Gerischer's model (pp. 78–80) is likewise a point where the reader would like to know whether the different theories can be distinguished experimentally.

The book is well presented with many clear diagrams and a useful set of references. There are very few blemishes in the text, only the implication (pp. 75–76) that electron transfers at semiconductor electrodes do not obey the principle of microscopic reversibility.

Professor Kuznetsov is to be congratulated on a valuable account of the theory of electron transfer that should be read by all who wish to understand this important area of quantum mechanical theory.

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Electrochemical Phase Formation and Growth. An Introduction to the Initial Stages of Metal Deposition
by E. Budevski, G. Staikov and W. J. Lorenz (VCH, Weinheim 1996) £70 ISBN 3 527 29422 8, 410 pp

The authors have a long track record in the application of electrochemical techniques to the study of phase formation at the solid–liquid interface. Their text comprises six chapters: namely, Fundamentals of electrocrystallisation of metals, Crystalline metal surfaces, Underpotential deposition of metals – 2D phases, Initial stages of bulk phase formation, Growth of crystalline faces and Metal deposits and surface structuring and modifications. Finally, additional information is provided in several comprehensive appendices (compilation of experimental data, mathematical treatment of various theoretical models), a lists of chapter references, a compilation of abbreviations and symbols developed in the text, an author index and finally a subject index.

Throughout, the topics are clearly developed with numerous helpful diagrams, tables and plots. In each case symbols are defined where needed and compiled in a list at the end of the work. Indeed, the authors deserve praise for the large number of sketches used to illustrate surface structures, growth mechanisms and theoretical models. Several figure are in colour and this facilitates the comprehension of three dimensional structures. It is worth emphasising the quality of the presentation because the subjects developed are rather complex and the reader soon discovers that the book goes further than the subtitle suggests. For a novice – but I suspect also for an expert – most chapters go beyond an introduction to the subject of electrochemical phase formation and growth. This is not a criticism as the text is well written and easy to read.

The effects of electrochemical parameters, crystallographic surface structures and surface defects are analysed in terms of thermodynamic and kinetic theoretical models. The validity and application of the models are discussed and illustrated with a large number of experimental electrochemical data taken from the literature as well as from the authors own work. The text contains a vast number of references (e.g. chapter three has 349 references) which cover the period from the end of the last century (J. W. Gibbs, 1978 and P. Curie, 1885) right up to and including 1995. Thus, this book provides a very comprehensive

review of the theoretical and experimental developments from early papers on the thermodynamics of crystallization to the latest *in situ* electrochemical studies with STM and AFM. In fact, experimental results produced by the latter techniques find a large place in the work and I suspect that the wealth and now quality of *in situ* observations, providing evidence at the atomic level for several proposed mechanisms, have been the driving force which motivated the authors to produce this very timely book. Other current topics are included, for example, in Chapter 6 readers will find a discussion of electrochemical studies concerned with the use of semiconductor substrates and with the deposition of high temperature superconductors and ultrathin films.

I have enjoyed reading this publication. I have found it useful, up to date, clearly presented and well written. I can recommend it to anyone working in electrochemistry, physics or material science who is interested in understanding such topics as under and overpotential metal deposition.

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