

# Preface

As undertaken by electrochemists, spectroscopic, topographical and numerous other non-electrochemical methods extensively covered in this book have driven the investigation of structure and dynamics at phase boundaries between condensed matter influenced by the presence and action of both an electric field and charged particles (like ions in solution or electrons in a metal) towards significant advances in recent years. They are based in particular upon an intense use of spectroscopic and surface sensitive methods adapted to the particular needs of *in situ* investigations of these electrochemical interfaces. Consequently the area is called (not completely exactly) spectroelectrochemistry. More recently, scanning probes capable of mapping the interface and providing a more or less topographic image have become available.

Numerous reviews covering single methods or families of related methods have appeared in journals, monographs and volumes of series. In addition, books containing collected review papers have been published. The articles were written by specialists and experts in the respective methods and describe fundamental and applied aspects, including examples of successful applications. Unfortunately this approach cannot provide the full picture because coherence is lacking between methods and different but related properties and other aspects of a given system investigated with various methods. In addition, the papers are generally of a somewhat different level; sometimes they are filled with a flood of details or extensive repetitions of fundamental information already provided in standard textbooks. The present book attempts to close this gap by providing the generalist's view. It offers a broad collection of spectroscopic and surface sensitive techniques currently employed in investigations of electrochemical systems. Relationships between different methods pertaining both to the principles of the methods and the properties of the investigated systems are highlighted. In many cases examples illustrating the power and the potential of a combined use of several spectroelectrochemical techniques are discussed in detail.

As presumably nobody can be an expert in all discussed methods and techniques, this book will not cover all methods with the same intensity and expertise. Nevertheless, all reported methods are described in sufficient detail, enabling the reader to access the current literature, to evaluate the methods and to choose methods of potential use for his given problem. This is the main purpose of the book: to serve as a

guide to the successful application of spectroelectrochemistry and surface analytical methods in electrochemistry—just like a toolbox.

This book is based on numerous original papers and reviews. Because of the immense number of original papers and reviews, I have only provided references to those that I have assumed to be of particular importance as an introduction or that offer essential details not covered in this text. I wish to express my sincere apologies to all authors who have published important results and are not quoted explicitly within this book. Their contributions are nevertheless highly esteemed. Personal communications and experience with several methods in the laboratory of our research group and numerous contributions from coworkers and colleagues added to the base of this book. Some of them provided papers and preprints, examined experimental details, supplied original data or checked parts of the manuscript. Help and contributions from V. Brandl, M. Bron, C.H. Hamann, J. Lippe, A. Malinauskas, M. Probst, S. Schomaker, B. Speiser and B. Westerhoff are gratefully acknowledged. W. Vielstich introduced me to electrochemistry, E.B. Yeager provided inspiring access to new areas of research and to new methods during my postdoctoral stay at his laboratory, G. Comsa initiated a continuing interest in surface science and C.H. Hamann was an inspiring discussion partner. Without their stimulating support this book would have remained unwritten. Close cooperation and helpful assistance in planning and preparing this book by the staff of Springer-Verlag (Heidelberg), in particular by Claus Ascheron, Angela Lahee and Adelheid Duhm, are gratefully appreciated. My wife's tolerance for many hours spent in front of computer terminals and scientific papers was the essential prerequisite. The book would have been impossible without this.

Chemnitz, September 2008

R. Holze

*The best books are those which make the reader supplement them.*  
(Voltaire, *Philosophical Dictionary*, Foreword)

*It is vain to do with more what can be done with less (Entia non sunt multiplicanda praeter necessitatem).*  
(William of Occam)



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