

Preface

Spectroscopy in Catalysis is an introduction to the most important analytical techniques that are nowadays used in catalysis and in catalytic surface chemistry. The aim of the book is to give the reader a feeling for the type of information that characterization techniques provide about questions concerning catalysts or catalytic phenomena, in routine or more advanced applications.

The title *Spectroscopy in Catalysis* is attractively compact, but not quite precise. The book also introduces microscopy, diffraction and temperature-programmed reaction methods, as these are important tools in the characterization of catalysts. As to applications, I have limited myself to supported metals, oxides, sulfides and metal single crystals. Zeolites, as well as techniques such as nuclear magnetic resonance and electron spin resonance, have been left out – mainly because I have little personal experience with these subjects. Catalysis would not be what it is without surface science. Hence, techniques that are applicable to study the surfaces of single crystals or metal foils used to model catalytic surfaces, have been included.

The book has been written as an introductory text rather than as an exhaustive review. It is meant for students at the start of their Ph.D. projects, and also for anyone else who needs a concise introduction to catalyst characterization. Each chapter describes the physical background and principles of a technique, a few recent applications to illustrate the type of information that can be obtained, and an evaluation of possibilities and limitations. Chapter 9 contains case studies which highlight a few important catalyst systems and illustrates the power of combining techniques. The Appendix, which incorporates the surface theory of metals and details of chemical bonding at surfaces, is included to provide a better insight into the results of photoemission, vibrational spectroscopy, and thermal desorption.

Finally, an important starting point is that reading the book should be enjoyable. Therefore, the book contains many illustrations, as few theoretical formulas as possible, and no mathematical derivations. I hope that the book will be useful and that it conveys some of the enthusiasm I feel for research in catalysis.

About the Third Edition

The present version of the book represents a completely revised update of the first edition as it appeared in 1993, and the second from 2000. Significant new developments in, for example, electron and scanning probe microscopy, synchrotron techniques and vibrational techniques called for revision and additions to the respective chapters. However, the other chapters have also been updated with recent examples, and references to relevant new literature. Many figures from the first two editions have subsequently been improved to make them more informative.

Since its publication, I have used the book as an accompanying text in courses on catalyst characterization, both at the Eindhoven University of Technology, the Netherlands Institute for Catalysis Research, NIOK, as well as in several short courses all over the world. It has been very rewarding to learn that several colleagues in catalysis have also adopted the book for their courses. I will be very grateful for comments and corrections.

Acknowledgments

When I obtained my Masters Degree in experimental physics at the Free University in Amsterdam in 1978, I was totally unaware that as interesting an area as catalysis, with so many challenges for the physicist, existed. I am particularly grateful to Adri van der Kraan and Nick Delgass who introduced me, via the Mössbauer effect in iron catalysts, to the field of catalysis. My Ph.D. advisors at Delft, Adri van der Kraan, Jan van Loef and Vladimir Ponec (Leiden), together with Roel Prins from Eindhoven, stimulated and helped me to pursue a career in catalysis, which now extends back almost 25 years.

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Hans Niemantsverdriet

