# X-Ray Absorption and X-Ray Emission Spectroscopy

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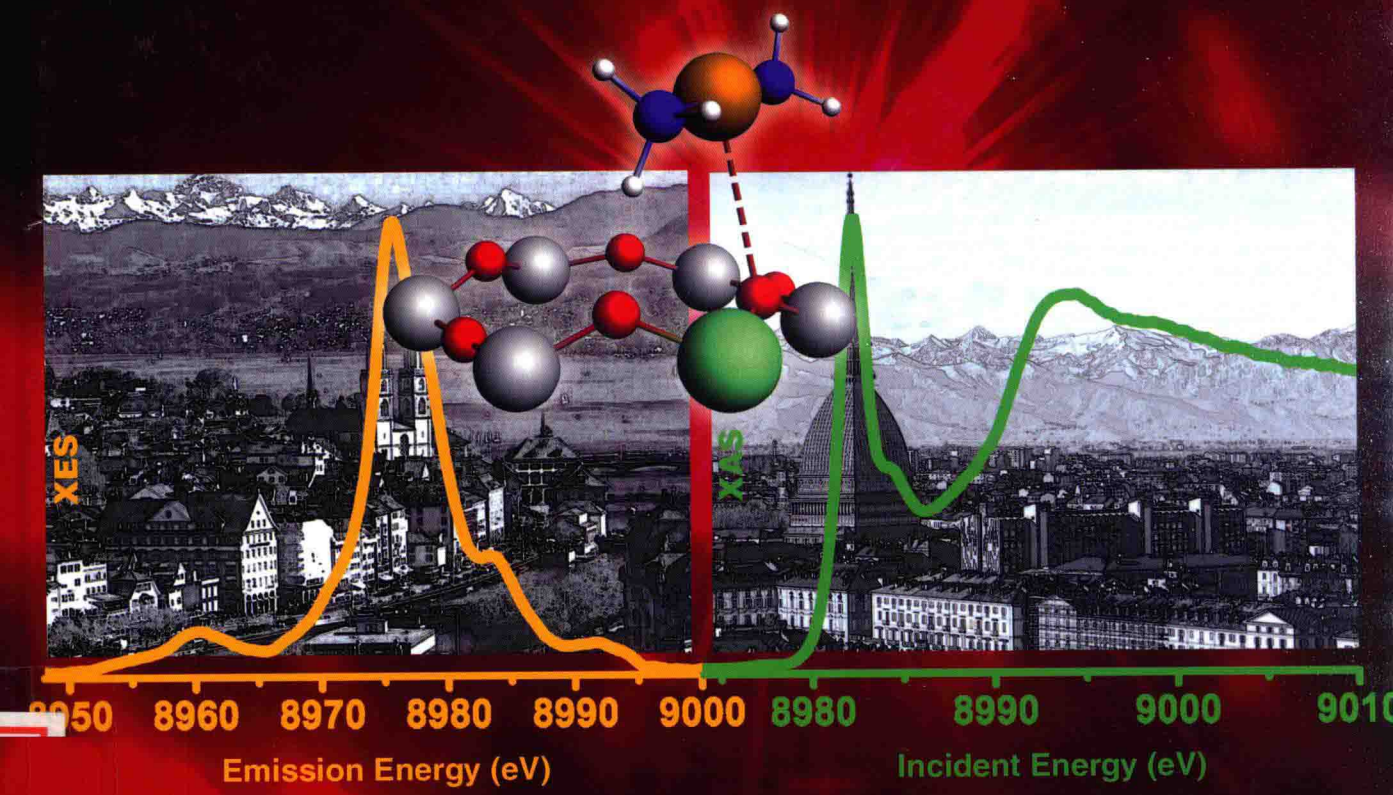
## *Theory and Applications*

EDITED BY **Jeroen A. van Bokhoven • Carlo Lamberti**

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# X-Ray Absorption and X-Ray Emission Spectroscopy

## Theory and Applications

VOLUME I

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# Foreword

With pleasure we accepted the invitation of the editors to write a Foreword for the book *XAS and XES: Theory and Applications*. This book is a follow-up to *X-Ray Absorption: Principles, Applications and Techniques of EXAFS, SEXAFS and XANES*, Wiley, 1987, which we edited.

X-ray absorption spectroscopy has changed considerably since the 1980s when EXAFS and XANES were relatively new techniques, synchrotrons were not dedicated and almost no user facilities were available. Night-time collection of data during a parasitic mode at the Stanford synchrotron was an adventure, to say the least. We survived it by listening to Bach's cantatas, as rendered by one of our PhD students.

When we began working with EXAFS spectroscopy in the 1980s, adsorbate-induced structural changes and metal-support interactions were hot topics in catalytic research. At that time we were interested in the change in morphology that CO adsorption induced on a $\gamma$-$Al_2O_3$-supported Rh catalyst and in the structure of the interface between rhodium metal particles and the catalyst support. To study the morphology change and metal-support interface *in situ*, we applied EXAFS, but at that time it was necessary to make the long trip to the Stanford Synchrotron in the USA where we were grateful for the measuring time allotted to us by our American colleagues Dale Sayers and Jim Katzer. Our first results were published in 1983 [1] and 1985 [2]. These studies demonstrated the exciting potential of EXAFS. We were, of course, not the only scientists interested in EXAFS. There was a need in the scientific community for a basic tutorial on X-Ray Absorption Fine structure present in the near edge region (XANES) and beyond (EXAFS). Inspired by stimulating contacts with scientific colleagues from around the world and the constant but positive pressure of the publisher (Wiley), we decided to edit a book that would provide information to students and scientists as a reference book to conduct XAS studies and, more advanced, to measure and interpret data. Information about a visit to a synchrotron was even more important in those days of parasitic measuring than today, so the physics of a synchrotron was included. We were fortunate enough to receive contributions from the most qualified and renowned scientists. Since then, the book has been used by many researchers, and more than 1,400 copies have been sold.

The field of x-ray absorption has developed considerably since 1987. On average, about 2000 papers on XAS are published yearly in scientific journals. More sophisticated instrumentation with extremely high resolution has enabled the development of new tools and techniques, such as x-ray emission spectroscopy. Promising applications of this technique have been developed in the past 20 years, making this book an essential reference work in this field.

It is a great pleasure that our student and collaborator, Jeroen A. van Bokhoven, and his colleague, Carlo Lamberti, have taken the initiative to edit a new volume, with Wiley as the enthusiastic publisher. Twenty-eight years after the appearance of our book, we are pleased that highly qualified scientists have made contributions to *XAS and XES: Theory and Applications*, which also includes x-ray emission spectroscopy. These contributions and the work of the enthusiastic and well-known editors have resulted in a book, which not only provides an essential introduction to the field of XAS and XES, but also demonstrates the enormous potential of these techniques for the study of structural and electronic properties of many types of matter.

The book has 27 chapters, divided into two volumes. The 12 chapters in Volume I describe the experimental and theoretical aspects of XAS and XES. The 15 chapters in Volume II focus on the enormous potential of both spectroscopic techniques with many important applications. The first volume contains an introduction by the editors. They start with a detailed historical overview of the past 100 years of x-ray absorption, mentioning

many important scientific contributions. At this point we would like to refer to the monumental papers in 1971 [3] and in 1974 [4] by our friends Dale Sayers, Ed Stern and Farrel Lytle. Their contributions were crucial in developing EXAFS from a scientific curiosity to an extremely important analytical tool. Both Ed Stern and Dale Sayers made important contributions to our book, published in 1987.

Jeroen A. van Bokhoven and Carlo Lamberti have performed a heroic task in completing the new book in such a short time. Experts in the various subfields reviewed the chapters. The book will be of great importance for beginners in the fields of XAS and XES. They will find all the information necessary to become experts. Also experienced users active in particular subfields of both spectroscopies will learn in this book about the enormous potential of both XAS and XES for other applications. This will lead to more and better experiments and thus to better science. We are confident that the new book will find at least as great a readership as our book.

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