
Preface

More than five years have passed since the first edition of this book was published. Surface science is still a very active field of research, and the fact that the Nobel Prize 2007 in chemistry was awarded to Gerhard Ertl “*for his studies of chemical processes on solid surfaces*” reflects the recognition that surface science has received in recent years. Nevertheless, the traditional surface science approach of studying low-index surfaces and simple adsorbates is no longer the focus topic of the research in this field. Instead, the interest has been shifted to the study of more and more complex structures that are also relevant for nanotechnology and even life sciences. The growing complexity of the studied systems makes a close collaboration between theory and experiment actually more essential in order to gain deeper insights into these systems. In fact, there has also been substantial progress in the theoretical treatment of structures and processes on surfaces. Therefore it was time to revise and update this textbook.

First of all, in this second edition there is a new chapter on *Surface Magnetism* which reflects the growing interest in low-dimensional magnetic structures on surfaces for, e.g., the magnetic storage of data. In addition, all other chapters have been updated in order to take into account novel developments in theoretical surface science. This is reflected in the fact that there are now more than one hundred new references. For example, one of the “hot” topics in surface science is the structure and function of thin oxide films, so-called surface oxides; therefore a discussion of their appropriate theoretical description including some examples was added. Furthermore, the short section about STM theory was expanded, and recent ab initio based molecular dynamics simulations of molecular adsorption on surfaces are addressed. All other topics were carefully reviewed and new important results were incorporated.

As far as the chapter on perspectives is concerned, I decided to leave the list of topics unchanged. It is true that in every subject covered in this final chapter there has been significant progress in the last years, which is reflected in the new version of the chapter. However, all these fields have in my opinion

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not sufficiently matured yet so that it is still justified to consider them as promising subjects that deserve further consideration.

For the new parts of this textbook I am in particular indebted to my colleagues Stefan Blügel, George Kresse, Karsten Reuter and Werner Hofer for sharing their insights with me. Besides, I want to thank the PostDocs and graduate students of my new research group in Ulm, Benjamin Berberich, Christian Carbogno, Arezoo Dianat, Yoshihiro Gohda, Jan Kucera, Daniela Künzel, Thomas Markert, Christian Mosch, Sung Sakong, Armin Sauter, Sebastian Schnur, Katrin Tonigold. Doing research and teaching together with them provided a most stimulating background for the completion of this second edition. I also would like to acknowledge the continuing support of Claus Ascheron from Springer who initiated the completion of this second edition.

Finally I want to thank my wife Daniella and my children Noah and Samira for their encouragement and for reminding me from time to time that there are also other things beyond theoretical surface science.

Ulm
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Axel Groß



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Groß, A.

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