

# Surface Science: Foundations of Catalysis and Nanoscience



## Subject area

Physical Chemistry

## Description

This edition of this book has been fully revised and updated to reflect all the latest developments in the field and now includes an extensive discussion about nanoparticle growth and the quantum confinement effects in nanoscale systems

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Undergraduate, research

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The first edition of Kurt W. Kolasinski's book **Surface Science: Foundations of Catalysis and Nanoscience** was an almost immediate success and has been described as a 'classic of its time'. It bridged the gap between primer-type textbooks that just cover what is absolutely necessary for an advanced undergraduate

course in surface science and those heavy textbooks targeting mainly the research community, which are suited only for the most ambitious undergraduate students. The second, fully revised edition is substantially enlarged with two completely new chapters and new worked examples throughout the book, which increased its volume by more than 150 pages to 486 in total.

The author worked previously in the group of G Ertl, who was awarded last year's Nobel prize in Chemistry for his work in surface science. Kolasinski's current research is in the field of laser-induced surface phenomena and the growth of nanostructures on surfaces. Throughout the book he uses examples from his own and Ertl's work in order to illustrate the concepts that he is describing. The book aims at undergraduate students in Chemistry, Physics, Chemical Engineering and Materials Science taking advanced courses in surface science, as well as researchers and professionals, who want an 'up-to-date review of the subject'. It is divided into 8 chapters, each about 50 pages long with a summary of important concepts, suggestions for further reading, plenty of exercises and references.

Chapter 1, 'Bulk and Surface Structure', is a general introduction into the arrangement of atoms, the electronic structure and vibrational modes of clean surfaces. This chapter and the exercises require a relatively high level of previous knowledge of band structures and crystallography, which cannot be expected from all students of the target readership, however more fundamental textbooks are listed in the 'Further Reading' section, which provide this information.

Chapter 2, 'Experimental Probes and Techniques', explains all main experimental techniques used in surface science, molecular beams, scanning probe microscopy, low-energy electron diffraction, photoelectron and Auger-electron spectroscopy, and surface-sensitive vibrational spectroscopies in detail. The chapter goes well beyond a qualitative description of these methods and includes exact mathematical descriptions where possible, thus providing a very useful reference.

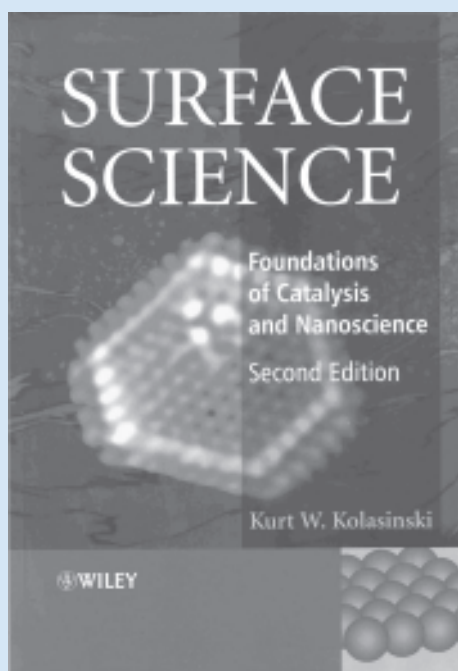
Chapters 3 and 4 'Chemisorption, Physisorption and Dynamics' and 'Thermodynamics and Kinetics of Adsorption and Desorption', are a real pleasure to read. They contain well balanced explanations of the concepts describing chemical bonds at surfaces, which are discussed using a number of classic examples, such as molecular CO adsorption (Blyholder model) and dissociative adsorption of hydrogen, and provide a thorough treatment of surface thermodynamics and kinetics.

## Summary Review

range: \* poor to \*\*\*\*\* good

Academic content	*****
Usefulness to student	****
Usefulness to teacher	*****
Meets objectives	*****
Accuracy	***

# Surface Science: Foundations of Catalysis and Nanoscience



From the publisher...

## **Surface Science: Foundations of Catalysis and Nanoscience, 2nd Edition**

By Kurt W. Kolasinski

Surface chemistry is an essential and developing area of physical chemistry and one that has become increasingly interdisciplinary. The Second Edition of *Surface Science: Foundations of Catalysis and Nanoscience* has been fully revised and updated to reflect all the latest developments in the field and now includes an extensive discussion about nanoparticle growth and the quantum confinement effects in nanoscale systems. Two new chapters have been added and discuss The Liquid/Solid Interface and Non-Thermal Reactions, and Photon and Electron Stimulated Chemistry and Atom Manipulation. There are now many more worked examples included throughout to help students develop their problem-solving skills.

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Chapter 5, 'Liquid Interfaces', is one of the two new chapters in the second edition and was added to cover also the material in this area that would normally be included in an undergraduate surface science course. It discusses the Young-Laplace equation, Kelvin equation, Gibbs isotherm, Langmuir-Blodgett films, etc. to sufficient detail, however, not at the same depth as the previous chapters.

Chapter 6, 'Heterogeneous Catalysis', returns to the in-depth style of the first four chapters and applies the thermodynamic and kinetic concepts developed there to heterogeneous catalysis in general. Some of the most important catalytic reactions, such as the Haber or Fischer-Tropsch processes, are used to illustrate the discussion.

The first half of chapter 7, 'Growth and Epitaxy' describes the thermodynamics and kinetics of growth processes in general discussing the standard growth modes, interface strain, nucleation theory and different ways of growing layers on surfaces. The second half of the chapter deals with some very interesting applications in nanotechnology.

The last chapter, 'Laser and Nonthermal Chemistry: Photon and Electron Stimulated Chemistry and Atom Manipulation', is a compilation of 'other interesting stuff' in surface science that did not quite fit into one of

the previous chapters. Examples discussed here include photo-stimulated surface processes, photovoltaics, electrochemistry, and manipulation of atoms using scanning tunnelling microscopes.

In addition to the usual lists of constants, abbreviations and symbols, the appendix also contains a very useful compilation of formulae, which do, however, lack a proper description of symbols (these have to be looked up in another list).

In my opinion the second edition is not always benefiting from the added material and is losing its focus at times. A more rigorous labelling of sections as 'essential' or 'advanced topic' would be helpful. Other points on the negative side are the large number of typing errors and the poor quality of some of the figures.

Nevertheless, this book should be compulsory reading for every postgraduate student starting to do research in surface science and is probably the best book on the market for undergraduate students, who want to learn more about this subject than what can be covered in a normal lecture course.