THE STRUCTURE OF RARE-EARTH METAL SURFACES



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CONTENTS

Preface	<i>page</i> xi
List of Acronyms	xiii
1 Introduction to the Rare Earths	1
1.1 What's in a Name?	2
1.2 Discovery of the Rare Earths 1.2.1 The Periodic Table	2 4
1.3 Defining the Rare Earths	6
1.4 Applications of the Rare Earths1.4.1 Oxides1.4.2 Metals1.4.3 Elements	7 7 8 9
 1.5 The Rare–Earth Metals 1.5.1 Electronic Configuration 1.5.2 Crystal Structure 1.5.3 Electronic Structure 1.5.4 Magnetic Structure 1.6 Rare–Earth Metal Surfaces 1.6.1 Early Surface Studies 	9 10 11 14 16 17 17
1.6.2 Surface Magnetism	18
2 The Basics of Surface Structure	21
2.1 Real and Ideal Surfaces	21
2.2 Surface Crystallography 2.2.1 Two–Dimensional Lattices	23 23

The Structure of Rare–Earth Metal Surfaces

2.2.2 Definitions of Surface Structure	25
2.2.3 HCP Surfaces	26
2.2.3.1 Structure Parallel to the Surface	26
2.2.3.2 Structure Perpendicular to the Surface	28
2.2.4 Notation for Overlayer Structures	32
2.2.5 Overlayers on Refractory Metal Substrates	34
2.2.6 Overlayers on BCC (110) Substrates	36
2.2.7 Overlayers on Other Metal Substrates	39
2.2.8 Overlayers on Semiconductor Substrates	39
2.2.9 Overlayers on Other Substrates	39
2.3 Surface Diffraction	40
2.3.1 The Reciprocal Lattice	40
2.3.2 Ewald Construction	43
2.3.3 Indexing the Lattice Points	47
2.3.4 Reconstructions and Overlayers	47
3 Surface Structure Techniques	49
3.1 Electron and X-Ray Diffraction	49
3.1.1 Low–Energy Electron Diffraction	50
3.1.1.1 LEED Optics	50
3.1.1.2 Measuring Intensities	52
3.1.2 Reflection High–Energy Electron Diffraction	55
3.1.3 Surface X-Ray Diffraction	58
3.1.3.1 Crystal Truncation Rods	61
3.2 Scanning Tunnelling Microscopy	63
3.3 Photoelectron Diffraction	67
4 Crystal Growth and Surface Preparation	71
4.1 Introduction	71
4.1.1 Bulk Samples or Thin Films?	72
4.2 Purification and Growth of Bulk Single Crystals	73
4.2.1 Purification	73
4.2.2 Bulk Crystal Growth	76
4.3 Preparation of Bulk Single–Crystal Surfaces	79

Contents

	4.4 Growth of Epitaxial Thin Films	86
	4.4.1 Growth Modes	86
	4.4.2 Measuring Film Thickness	91
	4.4.3 Growth of Open Surfaces	93
5	Rare–Earth Surface Science	99
	5.1 Introduction	99
	5.2 Geometric Structure	102
	5.2.1 Qualitative Low–Energy Electron Diffraction	102
	5.2.1.1 Surfaces of Bulk Crystals	102
	5.2.1.2 Surfaces of Thick Films	108
	5.2.1.3 Structure of Thin Films	110
	5.2.2 Reflection High–Energy Electron Diffraction	117
	5.2.3 Scanning Tunnelling Microscopy	120
	5.2.4 Other Structural Techniques	129
	5.2.4.1 Photoelectron Diffraction	129
	5.2.4.2 Electron Microscopy	132
	5.2.4.3 Medium–Energy Ion Scattering	134
	5.2.5 Growth Modes	134
	5.3 Electronic Structure	141
	5.3.1 Photoelectron Spectroscopy	141
	5.3.2 Core–Level Shifts	142
	5.3.3 Valence–Band Structure	147
	5.4 Surface Magnetism	149
	5.4.1 Surface–Enhanced Magnetic Order	151
	5.4.2 Surface–To–Bulk Coupling	151
6	Quantitative Low–Energy Electron Diffraction	155
	6.1 Quantitative LEED Experiments	156
	6.1.1 Electron Scattering	157
	6.1.2 Structure and LEED $I - V$	158
	6.2 Dynamical Calculations	159
	6.2.1 Atomic Scattering	159
	6.2.2 Intralayer Scattering	165
	6.2.3 Interlayer Scattering	169

The Structure of Rare–Earth Metal Surfaces

	6.3 Reliability Factors	170
	6.3.1 Zanazzi–Jona R-factor	171
	6.3.2 Pendry R-factor	171
	6.3.3 Van Hove and Tong R-factor	172
	6.3.4 Accuracy of a Structure Determination	173
	6.4 Tensor LEED	174
	6.4.1 TLEED Theory	175
	6.4.2 Structure Determination	176
7	Quantitative LEED Results	177
	7.1 (0001) Surfaces	178
	$7.1.1 \ Sc(0001)$	178
	7.1.2 Tb(0001)	183
	7.1.3 Gd(0001)	184
	7.1.4 Fingerprinting	188
	7.2 $(11\overline{2}0)$ Surfaces	189
	7.3 Calculated Surface Structures	191
	7.4 Outlook	194
8	Summary – Past, Present and Future	199
Appendix		203
	Tables of Rare–Earth Metal Surface Science Studies	
Acknowledgements		213
References		217
In	ndex	241

PREFACE

The Structure of Rare-Earth Metal Surfaces outlines the experimental techniques and theoretical calculations employed in the study of the atomic and nanoscale structure of surfaces and reviews their application to the surfaces of the rare-earth metals. In particular, the results of quantitative low-energy electron diffraction experiments and multiple-scattering calculations are covered in some detail due to their importance in the field of surface structure determination.

The aim of the book is two-fold. Firstly, it can be used by those new to the field of surface science as an introduction to surface crystallography, covering the basic principles and showing many examples of surfaces from a selection of elements from the periodic table. Secondly, it can be used as an introduction to the world of the rare-earth metals, and their surfaces in particular, giving a taste of the active research fields that are currently being explored. A full review of all of the many hundreds of studies that have been made of rare-earth metal surfaces is not attempted, as it would be too large a task and beyond the scope of this book. However, we thought that the information tabulated in the appendix, giving references for all studies that have some relevance to rare-earth metal surfaces, would be a valuable source of information for any student embarking on research in this or related fields.

Surface science is, by its very nature, an interdisciplinary science — often no clear boundaries exist between the physics, chemistry and materials science of surfaces. Any that do appear to exist are either imposed artificially or are very ill-defined, or perhaps both. This book may appear to fall into the category of surface physics, as it describes the principles and practice of determining the crystallographic structure of surfaces at the atomic and nanometre scales. However, by describing how the structures of surfaces are intimately linked to their electronic,

The Structure of Rare–Earth Metal Surfaces

magnetic and chemical properties, we show that surface structure cannot be studied in total isolation from these other aspects. We have aimed the book at science graduates with an interest in surface crystallography. Although a background in solid state physics will be helpful to the reader, by not relying too heavily on undergraduate physics we have tried to keep the content at a level such that graduates from disciplines other than physics will not be disadvantaged. Describing the theoretical treatment of surface atomic structure determination will inevitably require some mathematics, but where this is unavoidable the reader is led through the mathematics to see how the physics comes through, sacrificing rigour for clarity where possible.

We cannot give a comprehensive account of all aspects of either surface crystallography or the rare—earth metals, and so further reading paragraphs are provided at the end of some of the sections to guide the reader to review articles or books that give more detailed information on techniques, applications, or related studies.

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