

Contents

Contributors *vii*

Preface *ix*

1 Quartz Crystal Microbalances for Studies of Plasma-Surface Interactions **1**
J. W. Coburn

 I. Introduction 1

 II. Experimental Considerations 3

 III. Applications of Quartz Crystal Microbalances in
 Reactive Gas Glow Discharges 9

 IV. Summary and Acknowledgements 17

 References 18

2 Elemental Analysis of Treated Surfaces **19**
Donald L. Smith, H. P. Gillis, and Thomas M. Mayer

 I. Plasma and Surface Analysis 19

 II. Electron Spectroscopy 25

 III. Ion Spectroscopy 46

 References 63

3 Spectroscopic Ellipsometry in Plasma Processing **67**
D. E. Aspnes and R. P. H. Chang

 I. Introduction 68

 II. Fundamentals 72

 III. Instrumentation—A Spectroscopic Ellipsometric
 System for Plasma Processing 79

 IV. Optical Modelling 83

vi	Contents
V.	Representative Examples 89
VI.	Conclusion 107
	References 107
4	Ion Beam Analysis of Plasma-Exposed Surfaces 109
	<i>B. L. Doyle and Wei-Kan Chu</i>
I.	Ion Beam Analysis 110
II.	Rutherford Backscattering Spectrometry (RBS) 119
III.	Elastic Recoil Detection (ERD) 130
IV.	Particle Induced X-Ray Emission (PIXE) 138
V.	Nuclear Reaction Analysis (NRA) 145
VI.	Conclusions 153
	References 155
5	The Interpretation of Plasma Probes for Fusion Experiments 157
	<i>P. C. Stangeby</i>
I.	Introduction 157
II.	Survey of Probe Techniques 158
III.	Theoretical Basis for Interpretation of Probes in Very Strong Magnetic Fields 160
IV.	Langmuir Probe Interpretation 170
V.	Probe-Size and Limiter-Shadow Effects 185
VI.	Effect of Fluctuations 196
VII.	Impurity Effects 201
VIII.	Remaining Problems 205
IX.	Conclusions 207
	References 207
6	Analysis of Surfaces Exposed to Plasmas by Nondestructive Photoacoustic and Photothermal Techniques 211
	<i>B. K. Bein and J. Pelzl</i>
I.	Introduction 212
II.	Basic Theory of Thermal Waves 214
III.	Excitation and Detection Techniques for Thermal Waves . . 228
IV.	Thermal Wave Analysis of Plasma Treated Materials 243
V.	Thermal Wave Analysis of Plasma-Surface Interactions in Controlled Fusion 269
VI.	Conclusions 319
VII.	Acknowledgements 320
	References 320
Index	 327