

CONTENTS

<i>Preface</i>		ix
<i>Acknowledgments</i>		xi
CHAPTER 1	INTRODUCTION	1
	1.1 General Remarks	1
	1.2 A Comparison of Surface Vibration Spectroscopies	4
	1.3 The Electron Energy Loss Method of Surface Vibrational Spectroscopy: Introductory Remarks	9
	References	15
CHAPTER 2	INSTRUMENTATION	16
	2.1 Physical Requirements of Spectrometers	17
	2.2 Energy Dispersive Systems	20
	2.3 The Analysis of the Cylindrical Deflector	23
	2.4 Space-Charge Effects	34
	2.5 Space-Charge Effects on the Cylindrical Deflector	40
	2.6 Other Electrostatic Geometries	54
	2.7 Background	57
	2.8 Some Further Technical Aspects	59
	References	62
CHAPTER 3	BASIC THEORY OF ELECTRON ENERGY LOSS SPECTROSCOPY	63
	3.1 General Remarks	63
	3.2 Small-Angle Inelastic Scattering by Dipole Fields	66
	3.3 Bulk Losses in the Regime of Small-Angle Scattering	76
	3.4 Surface Losses	89

	3.5	The Impact Scattering Regime	102
	3.6	Technical Remarks	120
		References	125
CHAPTER 4		VIBRATIONAL MOTION OF MOLECULES ADSORBED ON THE SURFACE	127
	4.1	General Remarks	127
	4.2	Theory of the Vibrational Normal Modes of Adsorbed Molecules	135
	4.3	Elements of Group Theory	152
	4.4	Molecular Vibrations and Surface Point Groups	165
	4.5	Some Principles in Mode Assignment	193
		References	204
CHAPTER 5		VIBRATIONS AT CRYSTAL SURFACES; ORDERED ADSORBATE LAYERS AND THE CLEAN SURFACE	206
	5.1	General Remarks	206
	5.2	Formal Description of the Vibrations of Ordered Adsorbate Layers on Crystals	207
	5.3	The Study of Surface Phonons by Electron Energy Loss Spectroscopy	257
	5.4	Anharmonicity and Double Losses	268
		References	273
CHAPTER 6		APPLICATIONS OF VIBRATION SPECTROSCOPY IN SURFACE PHYSICS AND CHEMISTRY	275
	6.1	General Remarks	275
	6.2	Vibration Spectroscopy and the Determination of Adsorption Sites	276
	6.3	Frequency Shifts	296
	6.4	Overtones and Bond Energy	309
	6.5	Chemical Analysis of Adsorbed Species	314
		References	332

Contents		vii
CHAPTER 7	OUTLOOK	337
	References	342
APPENDIX A	EVALUATION OF THE FUNCTION $P(Q_{ }, \omega)$ FOR THE TWO-LAYER MODEL	343
	References	346
APPENDIX B	VIBRATIONAL FREQUENCIES OF SELECTED MOLECULES	347
	References	353
APPENDIX C	CONVERSION OF FREQUENCY UNITS	354
<i>Index</i>		363