

CONTENTS

CONTRIBUTORS	ix
PREFACE	xi
LIST OF VOLUMES IN TREATISE	xv

1. Theory of Scanning Tunneling Microscopy by J. TERSOFF and N. D. LANG	
1.1. Basic Principles	1
1.2. Theory of STM Imaging	5
1.3. Metal Surfaces: STM as Surface Topography	8
1.4. Semiconducting Surfaces: Role of Surface Electronic Structure	11
1.5. Adsorbates on Metal Surfaces	14
1.6. Close Approach of the Tip: The Strong-Coupling Regime. .	16
1.7. Tunneling Spectroscopy	22
1.8. Mechanical Tip-Sample Interactions	24
References	27

2. Design Considerations for an STM System by SANG-IL PARK and ROBERT C. BARRETT	
2.1. Introduction	31
2.2. Theoretical Considerations	33
2.3. Mechanical Structure and Components	51
2.4. Control Electronics	60
2.5. Common Problems and Further Improvements	66

Acknowledgments	75
References	75
3. Extensions of STM	
by H. KUMAR WICKRAMASINGHE	
3.1. Introduction	77
3.2. Historical	77
3.3. STM and Some Extensions	78
3.4. Near-Field Thermal Microscopy and Extensions	83
3.5. Scanning Force Microscopy and Applications	86
3.6. Conclusion	92
References	93
4. Methods of Tunneling Spectroscopy	
by JOSEPH A. STROSCIO and R. M. FEENSTRA	
4.1. Instrumentation	96
4.2. General Current versus Voltage Characteristics	100
4.3. Voltage-Dependent Imaging Measurements	104
4.4. Fixed Separation I - V Measurements	112
4.5. Variable Separation Measurements	134
References	145
5. Semiconductor Surfaces	
5.1. Silicon	149
by RUSSELL BECKER and ROBERT WOLKOW	
References	220
5.2. Germanium	225
by RUSSELL BECKER	
References	248

5.3. Gallium Arsenide.	251
by R. M. FEENSTRA and JOSEPH A. STROSCIO	
References	275
 6. Metal Surfaces	
by YOUNG KUK	
6.1. Introduction	277
6.2. Corrugation Amplitudes and the Tunneling Tip	278
6.3. Tunneling Spectroscopy of Metal Surfaces	280
6.4. Clean Metal Surfaces	286
6.5. Adsorbate on Metal Surfaces	293
6.6. Conclusion	303
Acknowledgment	303
References	303
 7. Ballistic Electron Emission Microscopy	
by L. D. BELL, W. J. KAISER, M. H. HECHT, and L. C. DAVIS	
7.1. Introduction	307
7.2. Theory	311
7.3. Experimental Details	326
7.4. Results	330
7.5. Conclusions	346
Acknowledgment	347
References	348
 8. Charge-Density Waves	
by R. V. COLEMAN, ZHENXI DAI, W. W. MCNAIRY,	
C. G. SLOUGH, and CHEN WANG	
8.1. Transition Metal Chalcogenides.	349

8.2. Charge-Density Wave Formation 350

8.3. Charge-Density Waves in Transition Metal Chalcogenides 352

8.4. Experimental STM and AFM Response to CDW Structures 352

8.5. Experimental Techniques. 355

8.6. 1T Phase Transition Metal Dichalcogenides 358

8.7. 2H Phase Transition Metal Dichalcogenides 385

8.8. 4Hb Phase Transition Metal Dichalcogenides. 393

8.9. Linear Chain Transition Metal Trichalcogenides 402

8.10. Conclusions 421

Acknowledgments 423

References 423

9. Superconductors
by HARALD F. HESS

9.1. Introduction 427

9.2. The Superconducting State 427

9.3. Experimental Techniques for STM on Superconductors. . . 430

9.4. Spectrum in Zero Field 432

9.5. Vortex Data 434

9.6. Interpretation 441

9.7. Conclusion 448

References 448

INDEX 451

