CAMBRIDGE

Cambridge University Press
0521019494 - Photoemission Studies of High-Temperature Superconductors
David W. Lynch and Clifford G. Olson
Table of Contents
More information

Contents

Preface *ix*

1 Introduction **1**

2 Structure and electronic structure of cuprates **9**
2.1 Crystal structures 11
2.2 Electronic structures 16
2.3 Surface states 32
2.4 Cluster models 34
2.5 Localized models for electronic structure 37
2.6 Doping 41
2.7 Stripe phases 44

3 Photoemission – Theory **47**
3.1 Introduction 47
3.2 The three-step model 50
3.2.1 Escape 50
3.2.2 Transport and inelastic scattering 51
3.2.3 Photoexcitation 56
3.2.4 Assembling the steps 63
3.2.5 Other types of spectra 64
3.3 Angle-resolved photoemission 67
3.4 An example 70

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
0521019494 - Photoemission Studies of High-Temperature Superconductors
David W. Lynch and Clifford G. Olson
Table of Contents
More information

3.5 Photoelectron and photohole lifetimes 78
3.6 Core-level spectra 84
3.7 The one-step model 87
3.8 Many-body treatment 91
3.9 Sudden vs. adiabatic limits 96
3.10 Inverse photoemission 98
3.11 Additional aspects of photoemission 101
3.11.1 Cooper minimum 102
3.11.2 Resonance photoemission 102
3.12 Core-level satellites 107
3.13 Gap states 111
3.14 Other spectroscopies 111

4 Photoemission – Experimental 119
4.1 Radiation sources 119
4.2 Monochromators 128
4.3 Other optical elements 134
4.4 Electron energy analyzers 135
4.5 Inverse photoemission 147
4.6 Background subtraction 149
4.7 Sample preparation 152
4.8 Potential improvements 159

5 Examples 161
5.1 Introduction 161
5.2 Sodium 162
5.3 Copper 165
5.4 Nickel 182
5.5 Nickel oxide 189
5.6 Cuprous oxide 203
5.7 Cupric oxide 206
5.8 Summary 212

6 Early photoelectron studies of cuprates 213
6.1 Introduction 213
6.2 Bi2212 220
6.3 Y123 232
6.4 $R_{2-x}Ce_xCuO_4$ 236
6.5 Other cuprates 239
6.6 Summary 241

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
0521019494 - Photoemission Studies of High-Temperature Superconductors
David W. Lynch and Clifford G. Olson
Table of Contents
More information

7 Bi2212 and other Bi-cuprates **243**
7.1 Bi2212 above T_c 244
7.1.1 Valence bands 244
7.1.2 Core levels 260
7.2 Bi2212 below T_c 262
7.3 Doping studies 285
7.4 Other Bi-cuprates 305
7.5 Summary 308

8 Y123 and related compounds **311**
8.1 Introduction 311
8.2 Ba 4d spectra 312
8.3 Valence bands and Fermi surface 314
8.4 Effects of stoichiometry 332
8.5 Core-level spectra 336
8.6 Related cuprates 337
8.7 Summary 339

9 NCCO and other cuprates **341**
9.1 NCCO 341
9.2 Other cuprates 350

10 Surface chemistry **357**
10.1 Oxygen removal and replacement, water adsorption 358
10.2 Metal overlayers on cuprates 360
10.2.1 Metals on CuO 361
10.2.2 Metals on Bi2212 and related cuprates 364
10.2.3 Metals on Y123 and related cuprates 373
10.2.4 Metals on other cuprates 373

11 New techniques in photoelectron spectroscopy **375**
11.1 Photoelectron microscopy 375
11.2 Angle-resolved resonance photoemission 380
11.3 Two-photon photoemission and related techniques 381
11.4 Coincidence techniques 382
11.5 Spin-resolved photoemission 384

12 Results from selected other techniques **387**
12.1 Infrared spectroscopy 387
12.2 Raman spectroscopy 389
12.3 Tunneling spectroscopy 394

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
0521019494 - Photoemission Studies of High-Temperature Superconductors
David W. Lynch and Clifford G. Olson
Table of Contents
More information

12.4 de Haas–van Alphen measurements 397
12.5 Angular correlation of positron–electron annihilation gamma rays 398
12.6 Electron energy-loss spectroscopy, soft x-ray absorption, and soft x-ray emission 399

References **405**

Index *429*

© Cambridge University Press www.cambridge.org