

Contents

1 Introduction	1
M. Cardona and G. Güntherodt	
1.1 Contents of the Present Volume.	2
1.1.1 Chapter 2	2
1.1.2 Chapter 3	5
1.1.3 Chapter 4	8
1.2 Selected Recent Developments	10
1.2.1 Resonant Raman Enhancement at Microcavities.	10
1.2.2 Effects of Anharmonicity on Phonon Raman Spectra.	12
1.2.3 Effect of Isotopic Composition on the Raman Spectra of Phonons in Semiconductors	13
1.2.4 Superlattices and Other Nanostructures: Phonons	16
References	23
2 Vibrational Spectroscopy of C₆₀	27
José Menéndez and John B. Page	
2.1 Vibrations in C ₆₀	27
2.1.1 Theoretical Basis	28
2.1.2 Symmetry and Selection Rules	30
2.1.3 Symmetry-Lowering Perturbations.	37
2.1.4 Survey of Theoretical Calculations	44
2.2 Vibrational Spectroscopy of C ₆₀ Molecules	50
2.2.1 The Assignment of Active and Silent Modes	51
2.2.2 First-Order Infrared Absorption and Raman Scattering Experiments.	52
2.2.3 Second-Order Infrared Absorption and Raman Scattering Experiments.	52
2.2.4 Isotopic and Crystalline Perturbations: Spectroscopic Evidence.	55
2.2.5 Quantitative Assessment of Isotope Effects	57
2.2.6 Inelastic Neutron Scattering	63
2.2.7 Optical Spectroscopy	66
2.2.8 High-Resolution Electron Energy Loss	69

2.2.9 Alternative Silent Mode Assignments	70
2.3 Infrared Absorption Intensities of C_{60}	73
2.4 Raman Intensities of C_{60}	79
2.4.1 Relative Intensities for Off-Resonance Scattering	79
2.4.2 Absolute Raman Cross Sections	85
2.4.3 Resonance Raman Scattering	86
2.5 Conclusion	89
References	90
3 Raman Scattering from Surface Phonons	96
Norbert Esser and Wolfgang Richter	
3.1 Surface Phonons	98
3.1.1 Dispersion of Surface Phonons	98
3.1.2 Experimental Methods	100
3.2 Fundamentals of Raman Spectroscopy	103
3.2.1 Energy and Wave-Vector Conservation	104
3.2.2 Scattering Intensity	105
3.2.3 Resonance Effects	108
3.2.4 Selection Rules	109
3.2.5 Experimental Setup for Raman Scattering	110
3.3 Antimony Monolayers on III-V (110)	112
3.3.1 Preparation of Ordered Sb Monolayers	114
3.3.2 Structure and Electronic Properties	114
3.3.3 Surface Phonons	117
3.3.4 Symmetry Considerations and Selection Rules	119
3.3.5 Raman Scattering Efficiency	128
3.4 Monolayer Terminated Si (111) and InP(100) Surfaces	137
3.4.1 Surface Vibrations of Arsenic Terminated Silicon (111)	138
3.4.2 Hydrogen-Terminated Silicon(111)	145
3.4.3 Sulfur-Terminated InP (100)	147
3.5 Clean InP (110) Surfaces	149
3.6 Microscopic Interface Modes	156
3.7 Summary and Conclusions	160
References	161
4 Coherent Phonons in Condensed Media	169
Thomas Dekorsy, Gyu Cheon Cho, and Heinrich Kurz	
4.1 Introduction	169
4.2 Coherent-Phonon Generation	171
4.3 Detection of Coherent Phonons	174
4.4 Coherent LO Phonons in GaAs	177
4.4.1 Coherent-Phonon Generation and Detection in GaAs	177
4.4.2 Coupled Plasmon--Phonon Modes	182

4.4.3 Coherent Control of LO Phonons	186
4.5 Coherent Phonons in Low-dimensional Semiconductors	187
4.5.1 Coupled Intersubband-Plasmon Phonon Modes in Quantum Wells	187
4.5.2 Coupled Coherent Bloch-Phonon Oscillations in Superlattices	189
4.5.3 Coherent Acoustic Phonons in Superlattices	192
4.6 Coherent Phonons in Tellurium	194
4.6.1 Selection Rules for Coherent-Phonon Detection in Te	194
4.6.2 Terahertz Emission from Coherent Phonons.....	196
4.6.3 Impulsive-Mode Softening of Phonons	198
4.7 Coherent Phonons in Other Materials	200
4.7.1 Coherent Phonons in High-temperature Superconductors .. .	200
4.7.2 Coherent Phonon-Polaritons in Ferroelectric Crystals	202
4.8 Recent Developments	202
4.9 Conclusions	204
References	204
Index.....	211