

Contents

<i>Preface</i>	<i>page</i> xiii
<i>Acknowledgements</i>	xv
<i>Notes for reference</i>	xvi
<i>Constants</i>	xvi
<i>Useful relationships</i>	xvi
<i>Electromagnetic spectrum</i>	xvii
<i>Simple functional groups</i>	xviii
1 The bulk phases of matter	1
1.1 Gases, liquids and solids	1
1.2 Liquid crystals	2
1.3 Phase changes	4
1.4 Thermodynamic equilibrium	8
1.5 Phase rule	9
<i>References</i>	10
2 Monolayers: two-dimensional phases	12
2.1 The gas–liquid interface	12
2.2 Monolayer materials	14
2.3 Monolayer stability	16
2.4 Monolayer phases	17
2.5 Monolayer compressibility and viscosity	30
2.6 Electrical effects in monolayers	31
2.7 Mixed monolayers	35
2.8 Chemistry in monolayers	37
<i>References</i>	37

3	Film deposition	39
3.1	Deposition principles	39
3.2	Deposition speed	43
3.3	Molecular re-arrangement	43
3.4	First layer effects and epitaxy	45
3.5	Defects	47
3.6	Deposition onto rough or porous surfaces	48
3.7	Equipment for LB deposition	49
3.8	Experimental techniques	55
3.9	Post deposition treatments	58
3.10	Related thin film deposition techniques	60
	<i>References</i>	63
4	Monolayer materials	65
4.1	Fatty acids and related compounds	65
4.2	Simple substituted aromatic compounds	69
4.3	Dyes	73
4.4	Porphyrins and phthalocyanines	75
4.5	Fullerenes	76
4.6	Charge-transfer complexes	77
4.7	Polymers	78
4.8	Biological compounds	83
	<i>References</i>	91
5	Structure of multilayer films	94
5.1	Organization in long-chain materials	94
5.2	X-ray reflection	98
5.3	Neutron reflection	104
5.4	Electron microscopy	106
5.5	Infrared spectroscopy	112
5.6	Scanning tunnelling and atomic force microscopies	121
5.7	Surface analytical techniques	124
5.8	Film thickness measurements	126
5.9	Other methods	127
	<i>References</i>	128
6	Electrical phenomena	131
6.1	Basic ideas	131
6.2	Practical considerations	134
6.3	Quantum mechanical tunnelling	139
6.4	Space-charge injection	141
6.5	Schottky and Poole-Frenkel effects	143
6.6	Dielectric processes	145

6.7 Semiconducting multilayers	150
6.8 LB film devices	153
<i>References</i>	164
7 Optical properties	167
7.1 Refractive index	167
7.2 Ellipsometry	168
7.3 The evanescent field	170
7.4 Surface plasmon polaritons	171
7.5 Optical waveguiding	175
7.6 Dye layers	179
7.7 Second-order nonlinear optical behaviour	186
7.8 Third-order nonlinear optical effects	194
<i>References</i>	194
<i>Appendices</i>	
A Electronic energy levels in organic solids	197
A.1 Bonding in organics	197
A.2 Band theory	203
<i>Further reading</i>	206
B Interaction of electromagnetic radiation with organic thin films	207
B.1 Electromagnetic radiation	207
B.2 Interaction with solids	208
B.3 Linear optics	209
B.4 Nonlinear optics	211
B.5 Reflection and transmission from thin films	212
B.6 Absorption processes	216
B.7 Emission processes	220
<i>Further reading</i>	221
C Crystallography	222
C.1 The crystal lattice	222
C.2 Crystal systems	222
C.3 Miller indices	224
C.4 Distance between crystal planes	225
<i>Further reading</i>	226
<i>Materials index</i>	227
<i>Subject index</i>	229