## Contents

Series Editors' Preface Preface						
					Li	List of Symbols
1	The	oretical Background	1			
	1.1	Introduction	1			
	1.2	Behaviour of insulators	2			
	1.3	Theory of reflection and refraction of electromagnetic				
		waves by insulators	4			
	1.4	Behaviour of absorbing materials	8			
	1.5	Variation with frequency—dispersion theory	14			
	1.6	Quantum theory of electrons in solids	23			
		References	32			
2	Experimental Methods for Measuring the Optical Constants					
	of B	ulk Materials	34			
	2.1	Introduction	34			
	2.2	Surface of specimen	34			
	2.3	Radiation detectors and noise	38			
	2.4	Radiation sources and optical windows	42			
	2.5	Techniques for non-absorbing materials	43			
	2.6	Photometric methods for absorbing materials	44			
	2.7	Polarimetric methods	48			
	2.8	Ellipsometric methods	49			
	2.9	Accuracy studies	61			
		References	72			
3	Kramers–Kronig Methods for Calculating Optical Constants					
	3.1	Introduction	75			
	3.2	Complex frequency plane	76			
			v			

	3.3	Causality	77
	3.4	Optical impedances	78
	3.5	Contour integration	78
	3.6	Practical applications of Kramers–Kronig relations	83
	3.7	Sum rules	84
		References	85
4	Resu	ilts for Bulk Specimens	86
	4.1	Introduction	86
	4.2	Metals	86
	4.3	Alloys	123
	4.4	Dielectrics	126
	4.5	Ferroelectrics	129
	4.6	Semiconductors	131
		References	134
5	Thir	n Films (Preparation and Theory)	140
	5.1	The importance of thin films	140
	5.2	Production of thin films	140
	5.3	Measuring and monitoring film thickness	146
	5.4	Film growth and structure	148
	5.5	Optics of thin films	152
	5.6	Matrix methods for calculating $R$ and $T$ for thin films	161
		References	162
6	Dete	ermination of the Optical Constants of Thin Films	164
	6.1	Introduction	164
	6.2	Photometric techniques	165
	6.3	Polarimetry	170
	6.4	Mixed photometry and polarimetry	171
	6.5	Ellipsometry	171
	6.6	Accuracy studies on techniques for $n$ and $k$ for thin films	172
		References	185
7	Rest	ults for Thin Films	187
	7.1	Introduction	187
	7.2	Alkali metals	187
	7.3	Alkaline earths group	190
	7.4	Noble metals	191
	7.5	Aluminium	195
	7.6	Transition elements	198
	7.7	Other metals	203
	7.8	Alloys	205
	7.9	Dielectrics	206

	Contents	vii
7	7.10 Semiconductors	207
	References	210
8 ]	The Optics of Discontinuous Films	214
8	8.1 Introduction	214
8	8.2 Discrete island theories	216
8	8.3 Effective medium theory	225
8	8.4 Results for specific materials	228
8	8.5 Results for composites	235
	References	238
Inde	ex	241