

Contents

Introduction	1
1. Volume Plasmons	4
1.1 General Properties	4
1.2 The Eigenfrequency of Plasma Oscillations	5
1.3 The Dispersion Relation. The Loss Function	6
1.4 The Critical Wave Vector	10
1.5 Acoustic Plasmons	13
2. The Dielectric Function and the Loss Function of Bound Electrons	14
2.1 Elementary Remarks. The Plasma Frequency	14
2.2 The Loss Function	16
2.3 Anisotropic Excitations	18
2.4 The Dielectric Function $\epsilon_{GG'}(\omega, q)$	19
3. Excitation of Volume Plasmons	23
3.1 Excitation by Electrons	23
3.2 Excitation with X-Rays	30
3.3 Excitation by Light	33
4. The Energy Loss Spectrum of Electrons and the Loss Function	35
4.1 Evaluation of the Loss Spectrum	35
4.2 Mean Free Path Length	40
4.3 Multiple Losses	42
5. Experimental Results	45
6. The Loss Width	65
6.1 The Dispersion of the Loss Width	65
6.2 Influence of the Crystal Size on the Loss Width	67
6.3 Comparison with Theory	69

7. The Wave Vector Dependency of the Energy of the Volume Plasmon	74
7.1 Dispersion at Small Wave Vectors ($q < q_c$)	74
7.2 Dispersion at Large q Values	89
7.3 Excitation of Bound Electrons with Momentum Transfer	94
7.4 Anisotropy of the Intensity of Volume Plasmon Losses	102
8. Core Excitations. Application to Microanalysis	105
9. Energy Losses by Excitation of Cerenkov Radiation and Guided Light Modes	112
9.1 Cerenkov Radiation	112
9.2 Excitation of Guided Light Modes by Electrons	114
10. Surface Excitations	116
10.1 Surface Plasmons	116
10.2 Excitation of Surface Plasmons	128
10.3 Results on Radiative Plasmons	130
10.4 Results on Nonradiative Plasmons	136
10.5 Surface Waves	165
10.6 2D and 1D Plasmons	166
11. Different Electron Energy Loss Spectrometers	172
Notes Added in Proof	181
References	183
Subject Index	193

