

## CONTENT

	Page
Foreword	5
Notation	11
1. Gas cleaning in general	17
1.1 Layouts and functioning of precipitations	22
2. Electric Fields	38
2.1 The electric field in tubular precipitators	39
2.2 The electric field between a wire and two flat electrodes	41
2.3 The electric field in plate-type precipitators	44
2.4 Lines of force in electrostatic fields	49
2.5 Capacities of electrostatic precipitators	56
2.6 Nature of the electric field	58
3. Corona Discharges	62
3.1 Coronas in clean and in polluted gases	63
3.2 Initial and critical initial field strengths	64
3.3 Relative gas density	67
3.4 Critical initial voltage	68
3.5 Voltage needed to counter the particle space charge	70
3.6 Voltage equation of an electrostatic precipitator	71
3.7 Applied, net available, and ionizing voltages	72
3.8 Radius of the active zone	73
3.9 Ionizing voltage	75
3.10 Current-voltage characteristic of a corona discharge	78
3.11 Ion mobility	79
3.12 Basic structure of the relation governing the current-voltage characteristic	79
3.13 Current-voltage characteristic of tubular precipitators	85
3.14 Current-voltage characteristic of plate-type precipitators	88
3.15 Current-voltage characteristic in polluted gases	91
3.16 Ionic current density	91
3.17 Effect of ion and particle space charges on the field distribution	92
3.18 Relations for computing the current-voltage characteristics of plate-type precipitators	94
3.19 Spark-over voltage	98
3.20 Ways of rationalizing the design data	100
4. Charging of Particle suspensions	104
4.1 Charging by ion bombardment	105
4.2 Charging by ion diffusion	112
4.3 The complex particle charging process	114
4.4 Charging in a homogeneous d.c. field	120
4.5 Charging in a rectified field	120
4.6 Charging in an a.c. field	122
4.7 Simplified calculation of the charging process	124
4.8 Charging of polydisperse particle suspensions	128
5. Motions of Admixture Particles	136
5.1 Forces acting on the particles	137
5.2 Resistance of the gas flow	138
5.3 Particle motions in general	141
5.4 Motions of fine and of coarse particle fractions	147
5.5 Fractional and apparent drift velocities	150

5.6	How the particle size affects the drift velocity	152
5.7	How the ion flow affects the gas and particle motions	162
5.8	Characteristics of the particle motion	166
6.	Formation and Removal of Deposit Layers	168
6.1	Settling of particles on the electrodes	169
6.2	Formation of deposit layers	169
6.3	Growth of the layer thickness	174
6.4	Effect of particle acceleration on the deposition process	180
6.5	Effect of the electrode collecting capacity and precipitator design	182
7.	Behaviour of deposit Layers	188
7.1	Nature, behaviour and effects of deposit layers	189
7.2	Electrical properties of the layers	192
7.3	Discharging of deposit layers	196
7.4	Back coronas	200
7.5	Distortion of particle motions by back coronas	211
7.6	Means of suppressing the effects of back coronas	212
7.7	Gas conditioning to improve precipitator performance	214
8.	The Separating Process in Electrostatic Precipitators	218
8.1	Collecting efficiency calculations	220
8.2	Internal dynamics of the precipitation process	225
8.3	Procedures for calculating the collecting efficiency	236
8.4	Factors affecting the precipitation process	255
9.	Precipitator Design and Components	258
9.1	Basic design principles	259
9.2	Classification of precipitators	266
9.3	Tubular precipitators	266
9.4	Plate-type precipitators	271
9.5	Insulators	282
9.6	Design of two-stage precipitators	286
9.7	Design of electric filters	287
9.8	Design of combined separator sets	288
9.9	Hopper evacuating equipment	290
9.10	Integration of precipitators in the plant equipment	291
9.11	Efficiency losses caused by non-uniform flow distribution	293
9.12	Causes of gas flow variations in precipitators	299
10.	Powering of Precipitators	304
11.	Some Industrial Applications of Precipitators	311
11.1	Influence of the process equipment on the precipitators	312
11.2	The emission-generating process equipment	314
11.3	Precipitation of fly ashes from steam generators	314
11.4	Dust trapping in cement factories	319
11.5	Trapping brown coal dust in drying fumes	323
11.6	Trapping stone coal dust in drying fumes	324
11.7	Precipitators in sodium cellulose plants	325
11.8	Precipitators in the production of carbon black	326
11.9	Precipitators in the iron and steel industry	328
11.10	Cleaning of air recirculating in enclosed premiss	337
	References	348
	Index	360