Contents

Pr	eface		V	
Li	st of f	igures	xiv	
1	Introduction			
I	Pro	perties of small particles and their behavior in gases		
2	Nan	oclusters and microparticles in gases	7	
	2.1	Gas with small particles as physical object	7	
	2.2	Small particles in the Earth atmosphere	8	
	2.3	Methods of removal of dust particles from gas	12	
	2.4	Artificial small particles in gas	14	
	2.5	Electric processes in earth atmosphere	18	
	2.6	Dusty plasma of solar system	21	
	2.7	Problems	24	
3	Cluster properties and their modeling		26	
	3.1	Cluster structures	26	
	3.2	Phase transition in cluster	30	
	3.3	Analytical and computer modeling of clusters	36	
	3.4	The liquid drop model for clusters	38	
	3.5	Spectral properties of clusters	40	
	3.6	Problems	43	
4	Dynamics of collisions in buffer gas involving clusters		49	
	4.1	Hard sphere model in atomic physics	49	
	4.2	Models of atom collisions with cluster or small particle	53	
	4.3	Analytic and computer methods in cluster physics	55	
	4.4	Problems	58	



II	Pro	ocesses involving small particles in gases	
5	Transport phenomena in gases involving small particles		
	5.1	Cluster motion in gas in force field	67
	5.2	Mobility of charged clusters in gas in strong electric field	70
	5.3	Diffusion of clusters in gas	72
	5.4	Problems	75
6	Particle motion in gas flows		
	6.1	Relaxation of particle velocity in gas flow	76
	6.2	Gas flow in tubes	78
	6.3	Drift of particles in gas flows	84
	6.4	Particle departure on periphery of gas flow	87
	6.5	Problems	89
7	Processes in buffer gas on surface of small particles		
	7.1	Equilibrium of metal cluster with parent vapor in buffer gas	92
	7.2	Character of cluster growth due to attachment of free atoms	97
	7.3	Quenching of metastable atoms on cluster surface	100
	7.4	Character of combustion of small particles	103
	7.5	Kinetic and diffusion regime of particle combustion	108
	7.6	Recombination of charged clusters in buffer gas	109
	7.7	Problems	111
8	Charging of small particles in ionized gases		116
	8.1	Particle charging in dense buffer ionized gas	116
	8.2	Particle charging in dense gas discharge plasma	121
	8.3	Double layer of gas discharge	125
	8.4	Particle charging in rarefied ionized gas with free ions	127
	8.5	Particle charging in rarefied ionized gas with trapped ions	131
	8.6	Particle charging and screening in rarefied ionized gas	135
	8.7	The charge distribution of particles in ionized gas	140
	8.8	Charging of small clusters in ionized gas	142
	89	Problems	144

Contents	1X
COMENIA	IA

9	Cros	with of alustors and small narticles in buffer gas	150		
y	9.1	wth of clusters and small particles in buffer gas Types of nucleation processes	150		
	9.1	• • • • • • • • • • • • • • • • • • • •	152		
	9.2	Kinetic regime of cluster coagulation	156		
		Diffusion regime of cluster coagulation			
	9.4	Cluster coagulation in external field	158		
	9.5	Ostwald ripening	160		
	9.6	Method of molecular dynamics in nucleation processes	167		
	9.7	Problems	168		
10	Structures formed in aggregation of solid particles				
	10.1	Fractal aggregates	187		
	10.2	Growth of fractal aggregates	194		
	10.3	Growth of particle structures in external electric fields	198		
	10.4	Growth of elongated particle structures in electric field	200		
	10.5	Aerogels	207		
	10.6	Problems	210		
11	Con	clusion	215		
Appendix A Physical parameters					
	A .1	Fundamental physical constants	217		
	A.2	Melting and boiling points of elements	218		
Aı	opendix B Conversional factors		219		
	B.1	Conversional factors in formulas for atomic particles and small			
		particles	219		
Aj	Appendix C Transport coefficients of atomic particles in gases				
Bi	Bibliography				
In	Index				