

Contents

1	Introduction	1
	References	9
2	Test Benches of the IEE RAS' Pulsed Plasma Generators	13
2.1	Construction and Equipment of the Test Benches	13
2.2	Power Supplies for Pulsed Plasma Generators	14
2.2.1	Capacitive Power Supply CPS-25	15
2.2.2	Capacitive Power Supply CPS-10	22
2.3	Components of Power Supply	25
2.4	Diagnostic Methods and Measurement Equipment	30
2.4.1	Initial Parameters of Experiment	30
2.4.2	Pulsed Current	31
2.4.3	Voltage Drop Across Arc	32
2.4.4	Pulsed Pressure	33
2.4.5	Optical Registration	36
2.4.6	X-ray Registration	38
2.4.7	Data Registration and Processing System	40
	References	41
3	Pulsed Plasma Generators	43
3.1	Types of Electrodischarge Chambers	43
3.2	IEE RAS' Pulsed Plasma Generators	50
3.2.1	Design of Plasma Generators	51
3.3	Components of Plasma Generators' Electrodischarge Chambers	61
	References	72
4	Parameters of the Arc	73
4.1	Resistance	74
4.2	Electric Field Intensity in Generator PPG-3	80
4.3	Current Density	87

4.4	Inductance	88
4.5	Temperature	88
	References	92
5	Erosion of Electrodes	95
5.1	Specific Erosion of Electrodes	95
5.2	Liquid and Vapor Erosions	101
5.3	Erosion as Electrode Jets	106
5.4	Erosion as Electrode Surface Layer Ejection	110
5.5	Erosion and Molecular Weight of Gas	114
	References	116
6	Oscillations of Arc's Diameter	119
6.1	Acoustic Oscillations	119
6.2	Shock Wave Compression of Arc	122
6.3	Oscillations of Arc's Diameter Caused by Magnetic and Gas Pressures	126
6.4	Oscillations of Soft X-rays Irradiation Intensity	128
	References	132
7	Processes and Heat Transfer in Electrodischarge Chamber	135
7.1	Arcing in Coaxial Discharge Chamber	135
7.2	Arc Movement	142
7.3	Heat Transfer from Arc to Gas	147
7.3.1	Irradiation	147
7.3.2	Thermal Conductivity	149
7.3.3	Turbulent Heat Transfer	150
7.3.4	Shock Waves	151
7.3.5	Shock Waves in Hydrogen	152
7.3.6	Shock Waves in Helium	152
7.3.7	Shock Waves in Air	156
7.3.8	Impact of Electrode Jets on Heat Transfer	159
7.4	Energy in Arc and Heat Transfer Components	163
	References	164
8	Modes of Arcing	167
8.1	Arc at Refractory Electrodes	168
8.2	Arc at Fusible Electrodes	171
8.3	Multipulse Mode	172
8.4	Two-Arc Mode	174
8.5	Programmable Mode	175
	References	179

9	Arc Contraction: Modified Piza-Braginskii Critical Current	181
9.1	Arc at Initial Hydrogen Pressure of 5 MPa	181
9.2	Discharge in Helium	186
9.3	500 kA Arc at Tungsten Electrodes	189
9.4	1.6 MA Arc at Steel Electrodes	194
9.5	Soft X-rays Irradiation	198
9.6	Heating of Hydrogen by X-ray Irradiation	199
9.7	Arc Glow Change at Contraction	200
	References	201
10	Arc at Ultrahigh Pressure	203
10.1	Arc in Pre-compressed Gas	203
10.2	Arc at Current of 220 KA	211
10.3	Arc at Current of 500 KA	217
10.4	Arc at Current of 2 MA	222
10.5	Critical Pisa-Braginskii Current	224
	References	232
11	Energy Features of Plasma Generator	235
11.1	Energy Transfer Coefficients	235
11.2	Simulation of Plasma Generators Processes	241
	References	242
12	Applications of Pulsed Plasma Generators	243
12.1	Application of Plasma Generators in Scientific Researches	243
12.2	Application of Plasma Generators for Toxic Substances Destruction	246
	References	247
	Index	249