



---

---

# Contents

Preface	ix
<b>1 Introduction</b>	
Text	1
References	3
<b>2 Scope of Polymer Formation by Plasma Polymerization</b>	
2.1 Preferred Form of Plasma Polymers	4
2.2 Plasma-State Polymerization versus Plasma-Induced Polymerization	5
2.3 Plasma Polymerization versus Graft Polymerization	7
2.4 Plasma Polymerization versus Radiation Polymerization	9
References	10
<b>3 Fundamental Aspects of Gas-Phase Reactions</b>	
3.1 Gas in a Closed System	11
3.2 Diffusion and Flow of Gas	15
3.3 Flow Rate and System Pressure of Flow	18
References	18
<b>4 Fundamental Aspects of Ionized Gas</b>	
4.1 Plasma for Plasma Polymerization	19
4.2 Macroscopic Treatment of Glow Discharge	20
4.3 Microscopic Treatment of Glow Discharge	23
4.4 Microscopic Treatment of Plasma	35
References	43
<b>5 Fundamental Aspects of Polymerization</b>	
5.1 Classification of Polymerization by Growth Mechanism	44
5.2 Addition Polymerization	49

5.3	Radiation Polymerization	59
5.4	Polymerization in a Vacuum	63
	References	71
<b>6</b>	<b>Kinetic and Mechanistic Aspects of Plasma Polymerization</b>	
6.1	Role of Ionization in Plasma Polymerization	73
6.2	Growth Mechanism of Plasma Polymerization	79
6.3	Reactive Species in Plasma Polymerization	82
6.4	Free Radicals in Plasma Polymers	86
6.5	Incorporation of Nonpolymerizable Gases in Plasma Polymers	115
6.6	Interpretation of Plasma Diagnostic Data	131
6.7	Interpretation of Polymer Properties	143
6.8	Atomic (Nonmolecular) Nature of Plasma Polymerization	166
	References	176
<b>7</b>	<b>Competitive Ablation and Polymer Formation in Plasma</b>	
7.1	Overall Reactions in a Plasma Polymerization System	178
7.2	Classification of Gases for Plasma	183
7.3	Ablation by Plasma	184
7.4	Dependence of Ablation on Operational Parameters	186
7.5	Simultaneous Sputter Coating and Plasma Polymerization	189
	References	195
<b>8</b>	<b>Kinetic and Mechanistic Aspects of Polymer Deposition in Plasma Polymerization</b>	
8.1	Polymerization and Deposition Mechanisms	196
8.2	Mass Balance in a Plasma Polymerization System	201
8.3	Distribution of Polymer Deposition	205
8.4	Dependence of Growth Reactions on Diffusional (Kinetic) Path Length	229
8.5	Polymer Deposition in a Closed System and in a Flow System	253
8.6	Overall Kinetics of Polymer Deposition	260
8.7	Simultaneous Polymerization–Deposition Mechanisms	273
	References	275
<b>9</b>	<b>Operational Parameters of Plasma Polymerization</b>	
9.1	Pressure of a Steady-State Flow System	277
9.2	System Pressure under a Glow Discharge	279
9.3	Factors That Determine Pressure under a Glow Discharge	281
9.4	Monomer Flow Rate	287
9.5	Determination of Flow Rate	288

9.6	Meaning of Flow Rate in a Plasma Polymerization System	290
9.7	Power Input of Plasma Polymerization	292
9.8	Effect of Power on the Volume and Intensity of Plasma	292
9.9	Plasma Energy Density and Input Power	295
9.10	Discharge Power for Polymer-Forming Plasma	298
9.11	Composite Power Parameter for Plasma Polymerization	301
9.12	Domains of Plasma Polymerization	309
9.13	Location of Polymer-Collecting Surface and Frequency of Electric Power Source	313
9.14	Stationary and Moving Substrates	315
9.15	Magnetron Discharge for Plasma Polymerization	319
	References	332
<b>10</b>	<b>General Characteristics of Plasma Polymers</b>	
10.1	Free Radicals in Plasma Polymers	334
10.2	Internal Stress in Plasma Polymers	337
10.3	Solubility and Fusibility of Plasma Polymers	344
10.4	Surface Properties of Plasma Polymers	344
10.5	Permeability Characteristics of Plasma Polymers	355
10.6	Adhesion of Plasma Polymers	359
	References	369
<b>11</b>	<b>Electrical Properties of Plasma-Polymerized Thin Organic Films</b>	
11.1	Historical Background	370
11.2	Dielectric Properties of Plasma-Polymerized Organic Films	372
11.3	Electrical Conduction in Plasma-Polymerized Organic Films	395
11.4	Concluding Remarks	414
	References	416
	Index	419