

## CONTENT

	Page
Acknowledgement	xi
Introduction	xiii
 1. Materials for the Plastics Industry	 1
1.1 Physical Classification	1
1.2 Commercial Classification	3
1.3 Functional Classification	4
1.4 Chemical Classification	6
1.5 Olefin Polymers	6
1.6 Vinyl Polymers	14
1.7 Engineering Thermoplastics	23
1.8 Other Thermoplastics	28
1.9 Thermosetting Polymers	29
1.10 Blends and Alloys	34
 2. Decomposition, Combustion, and Propagation	 37
2.1 The Burning Process on a Micro Scale	37
2.2 The Burning Process on a Macro Scale	40
2.3 The Burning Process on a Mass Scale	50
2.4 Combustion and People	53
 3. Fire Response Characteristics	 65
3.1 Types of Fire Response Characteristics	65
3.2 Smolder Susceptibility	66
3.3 Ignitability	66
3.4 Flash-Fire Propensity	68
3.5 Flame Spread	71
3.6 Heat Release	72
3.7 Fire Endurance	72
3.8 Ease of Extinguishment	75
3.9 Smoke Evolution	75
3.10 Toxic Gas Evolution	75
3.11 Corrosive Gas Evolution	86
 4. Flammability Tests	 97
4.1 Types of Flammability Tests	106
4.2 Tests for Smolder Susceptibility	108
4.3 Tests for Ignitability	110
4.4 Tests for Flash-Fire Propensity	116
4.5 Tests for Flame Spread	119
4.6 Tests for Heat Release	142
4.7 Tests for Fire Endurance	143
4.8 Tests for Ease of Extinguishment	148
4.9 Tests for Smoke Evolution	149
4.10 Tests for Toxic Gas Evolution	154
4.11 Tests for Corrosive Gas Evolution	160
 5. Prevention, Inhibition, and Extinguishment	 167
5.1 Design of the Material	167
5.2 Flame Retardance Mechanisms	170
5.3 Flame Retarding Various Polymers	180
5.4 Smoke Retardance Mechanisms	183

5.5	Smoke Retarding Various Polymers	186
5.6	Smolder Retardance Mechanisms	188
5.7	Reducing Toxic Gas Evolution	189
5.8	Reducing Corrosive Gas Evolution	189
5.9	Design of the Application	190
5.10	Fire Control and Extinguishment	192
6.	Market Acceptance Criteria	197
6.1	Markets for the Plastic Industry	197
6.2	Types of Acceptance Criteria	198
6.3	The Building Market	199
6.4	The Transportation Market	207
6.5	The Packaging Market	212
6.6	The Electrical and Electronics Market	212
6.7	The Consumer Goods Market	217
6.8	The Industrial Goods Market	222
6.9	The International Market	223
7.	Flammability and Product Liability	237
7.1	History of Product Liability Litigation	237
7.2	Fire Losses and Litigation	239
7.3	Major Fire Litigation	242
7.4	Vulnerability of Plastics to Fire Litigation	243
8.	Flammability and Environmental Concerns	247
8.1	Chlorofluorocarbons and Flammability	247
8.2	Plastics in Solid Waste Incineration	248
9.	Commercial Fire, Smoke, and Smolder Retardants	251