

CONTENTS

Chapter 1 Understanding Big Molecules	9
The Early History of Polymers	11
The Discovery of Big Molecules	15
Crystallinity in Polymers	24
Chapter 2 Big Molecules from Small Ones	29
The Addition Mechanism	30
Derivatives of Ethylene	34
Copolymerization	37
The Condensation Mechanism	39
Nylon	42
Formaldehyde Condensates	44
The Rearrangement Mechanism	46
Polymerization in Practice	48
Bulk Polymerization of Styrene	51
High-pressure Polymerization of Ethylene	52
Suspension Polymerization of Vinyl Chloride	55
Emulsion Polymerization of Vinyl Acetate	57
Polycondensation of Nylon	58
Chapter 3 Making Big Molecules to Pattern	61
Structural Isomerism	63
Stereoisomerism	65
Tailor-made Molecules	69
Polymer Structure and Polymer Properties	74
Chapter 4 The Origins of Synthetic Polymers	83
Polymers for Cellulose	84
Coal Versus Oil	86
The Petrochemical Industry	94
Table: Types of Polymers	104

Chapter 5 Additives for Polymers	113
Preventing Degradation	114
Preventing Fire	118
Fillers	119
Plasticizers	122
Cellular Polymers	124
Cross-linking Agents	125
Chapter 6 From Polymer to Product	129
The Flow of Molten Polymers	130
Mixing	133
Extrusion	134
Injection Molding	140
Compression Molding	148
Other Methods	150
Processing Paints and Adhesives	158
Spinning Fibers	158
Chapter 7 Polymers in Use	161
Polymers in the Home	161
Polymers and Electronics	163
Polymers at High Temperature	164
Polymers and Transport	168
Polymers and Building	176
Other Uses of Polymers	179
The Foreseeable Future	179
Appendix	183
Glossary	185
Suggested Reading	188
Index	189