

TABLE OF CONTENTS

LIST OF ABBREVIATIONS	x
PREFACE	
Chapter I. INTRODUCTION	3
History of the Discovery of Various Types of Polyamides	3
Classification of Polyamides	
History	5
Chemical Classification of Polyamides	
Bibliography	10
Chapter II. PREPARATION OF POLYAMIDES BY POLYCONDENSATION	12
Polyamidation Reactions	13
Structure of Monomers and Their Ability to Form Polyamides	15
Influence of the Functionality of the Starting Substances	16
Ring Formation	17
Chemical Transformations in Functional Groups	21
Reference Tables	23
Bibliography	71
Chapter III. MECHANISM OF POLYCONDENSATION REACTIONS	80
Types of Polycondensation	80
Equilibrium Polycondensation	82
Initiation of the Macromolecular Chain	83
Growth of the Macromolecular Chain	83
General Principles	83
Degradation in Polycondensation Processes	87
Acidolysis	88
Alcoholysis	89
Exchange Reactions	90
Cyclic Macromolecules	93
Some General Features of Degradation Reactions	95
Growth Termination of the Macromolecular Chain	104
Relative Amounts of the Starting Substances	105
Chemical Changes in the Functional End Groups	

	page
Depletion of the Initial Monomer	116
Removal of Low Molecular Products	117
Cross Linking of Polyamides	119
Polycondensation Catalysts	120
Kinetics of Equilibrium Polycondensation	123
Interphase Polycondensation	130
Interphase Polycondensation as a Nonequilibrium Process	130
The Mechanism of Interphase Polycondensation	132
Initiation of Growth of the Macromolecular Chain	132
Growth of the Macromolecular Chain	133
Growth Termination in a Macromolecular Chain	135
Kinetics and Fundamental Principles of Interphase Polycondensation	137
Effect of Temperature	137
Effect of Duration of Reaction	139
Effect of Excess of One of the Components	140
Effect of Monofunctional Additives	141
Effect of the Concentration of the Reactants	144
Effect of Acid Acceptor	145
Effect of Emulsifiers	146
Influence of the Nature of the Emulsifier	148
Special Features of Interphase Polycondensation	148
Techniques of Interphase Polycondensation	149
Preparation of Polymers by Stirring	149
Preparation of Polymers Without Stirring	150
Bibliography	151
Chapter IV. PREPARATION OF POLYAMIDES BY POLYMERIZATION	157
The Various Kinds of Polymerization Reactions	
Preparation of Polyamides by Hydrolytic Polymerization	159
Capacity of Monomers for Hydrolytic Polymerization in Relation to Their Structure	159
Reaction Mechanisms of Hydrolytic Polymerization	163
Initiation of the Macromolecular Chain	164
Growth of the Macromolecular Chain	168
Exchange Processes	175
Ring-Chain Equilibrium	176
Termination of Growth of the Macromolecular Chain	179
Kinetics and Mechanism of Hydrolytic Polymerization of ϵ -Caprolactam	181
Preparation of Polyamides by the Catalytic Polymerization of Cyclic Lactams	185
Reaction Mechanism and Reaction Kinetics of the Catalytic Polymerization of Lactams	187

	page
Preparation of Polyamides by Decarboxylative Polymerization	193
Preparation of Polyamides by Copolymerization of Polyisocyanates with Polyhydric Alcohols or Polyamines	199
Preparation of Polyamides by Copolymerization of Diamines with bis-Ketenes	211
Preparation of Polyamides by Copolymerization of 2,2-bis-5(4,4)- Oxazolones with Diamines or Glycols	212
Preparation of Polyamides by Polymerization of Isocyanates	214
Preparation of Polyamides by the Polymerization of Unsaturated Amides	216
Bibliography	217
 Chapter V. PREPARATION OF MIXED POLYAMIDES	 223
Preparation of Mixed Polyamides by Means of Equilibrium Reactions	223
Preparation of Mixed Polyamides by Means of Nonequilibrium Reactions	236
Preparation of Polyamide Graft Copolymers	256
Preparation of Block Copolymers of Polyamides	257
Bibliography	259
 Chapter VI. CHEMICAL PROPERTIES OF HETERO-CHAIN POLYAMIDES	 264
Reactions Involving the Scission of Amide Links	265
Hydrolysis of Polyamides	265
Analysis of Polyamides	269
Acidolysis of Polyamides	270
Aminolysis of Polyamides	272
Amidolysis of Polyamides	273
Substitution of Hydrogen	273
Substitution of Hydrogen in the Amide Grouping in Polyamides	273
Determination of End Groups in Polyamides	275
Degradation and Cross-Linking	277
Oxidation of Polyamides	277
Cross-Linking of Polyamides	279
Effect of Radiations on Polyamides	281
Thermal Degradation of Polyamides	288
Mechanical Degradation of Polyamides	297
Other Reactions of Polyamides	298
Absorption of Various Substances by Polyamides	299
Bibliography	304
 Chapter VII. PHYSICAL PROPERTIES OF POLYAMIDES	 315
Solubility of Polyamides	315
Molecular Weight of Polyamides	326
Fractional Composition of Polyamides	335

	page
Thermal Properties of Polyamides	339
Melting Point as a Function of the Polyamide Structure	344
Optical Investigations on Polyamides	354
Infrared Spectroscopy	356
X-Ray and Electron-Microscopic Investigations of Polyamides	362
Study of Polyamides by Resonance Methods	371
Crystallization of Polyamides	372
Orientation on Stretching	384
Mechanical Properties of Polyamides	388
Electrical Properties of Polyamides	394
Structure	395
Other Physical Properties	397
Bibliography	399
Chapter VIII. PREPARATION AND USES OF POLYAMIDES	413
Technology of Preparation of Polyamides	413
Uses of Polyamides	413
Polyamides in the Manufacture of Synthetic Fibers	414
Dyeing and Bleaching of Polyamide Fibers and Textiles	417
Films	418
Polyamide Coatings and Adhesives	419
Manufacture of Polyamide Plastics	422
Other Applications of Polyamides	425
Bibliography	
Chapter IX. INDIVIDUAL POLYAMIDES	440
Polyhexamethyleneadipamide	440
Polyhexamethylenesebacamide	
Poly- ϵ -caproamide	452
Poly- ω -enanthamide	459
Poly- ω -pelargonamide	464
Poly- ω -undecaneamide	465
Mixed Polyamides	467
Polyurethans	471
Methylolpolyamides	475
Carbamide Resins	476
Bibliography	479
AUTHOR INDEX	482
SUBJECT INDEX	521