

HANSER

Industrial Polymers

Herausgegeben von E. Alfredo Campo

ISBN-10: 3-446-41119-4

ISBN-13: 978-3-446-41119-7

Inhaltsverzeichnis

Weitere Informationen oder Bestellungen unter

<http://www.hanser.de/978-3-446-41119-7>

sowie im Buchhandel

Contents

Preface	VII
1 Introduction to Industrial Polymers	1
1.1 Beginning of Industrial Polymers	2
1.2 Polymer Families	4
1.3 Thermoplastic Polymers	5
1.3.1 Classification of Polymers by Performance	5
1.3.2 Molecular Structure of Industrial Polymers	7
1.4 Manufacturing of Industrial Polymers	8
1.5 Compounding the Industrial Polymers	12
1.6 Additives	13
1.7 Fillers and Reinforcements	14
1.8 Impact Modifiers	15
1.9 Colorants	15
2 Polymeric Materials	17
2.1 Acrylonitrile-Butadiene-Styrene Copolymer (ABS)	17
2.1.1 Advantages of ABS	18
2.1.2 Disadvantages and Limitations of ABS	19
2.1.3 Typical Applications of ABS	19
2.2 Acetal (POM, Polyacetal)	20
2.2.1 Advantages of Acetal	23
2.2.2 Disadvantages and Limitations of Acetal	23
2.2.3 Typical Applications of Acetal	23
2.3 Polymethyl Metacrylate (Acrylic, PMMA)	25
2.3.1 Advantages of Acrylic	26
2.3.2 Disadvantages and Limitations of Acrylic	26
2.3.3 Typical Applications of Acrylic	27
2.4 High Temperature Nylon (HTN)	27
2.4.1 Advantages of HTN	28
2.4.2 Disadvantages and Limitations of HTN	29
2.4.3 Typical Applications of HTN	29
2.5 Ionomer Polymers	30
2.5.1 Advantages of Ionomers	31
2.5.2 Disadvantages and Limitations of Ionomers	31
2.5.3 Typical Applications of Ionomers	32
2.6 Liquid Crystal Polymer (LCP)	32
2.6.1 Advantages of LCP	33
2.6.2 Disadvantages and Limitations of LCP	33
2.6.3 Typical Applications of LCP	34
2.7 Polyamide (PA, Nylon)	34
2.7.1 Advantages of Nylon	37
2.7.2 Disadvantages and Limitations of Nylon	37
2.7.3 Typical Applications of Nylon	38

2.8	Polyetherimide (PEI)	40
2.8.1	Advantages of PEI	41
2.8.2	Disadvantages and Limitations of PEI	41
2.8.3	Typical Applications of PEI	42
2.9	Polyarylate (PAR)	42
2.9.1	Advantages of PAR	44
2.9.2	Disadvantages and Limitations of PAR	44
2.9.3	Typical Applications of PAR	45
2.10	Polyetherether Ketone (PEEK)	45
2.10.1	Advantages of PEEK	46
2.10.2	Disadvantages and Limitations of PEEK	47
2.10.3	Typical Applications of PEEK	47
2.11	Polycarbonate (PC)	47
2.11.1	Advantages of PC	49
2.11.2	Disadvantages and Limitations of PC	49
2.11.3	Typical Applications of PC	50
2.12	Modified Polyphenylene Oxide (PPO)	51
2.12.1	Advantages of PPO	52
2.12.2	Disadvantages and Limitations of PPO	53
2.12.3	Typical Applications of PPO	53
2.13	Polybutylene Terephthalate (PBT)	54
2.13.1	Advantages of PBT	55
2.13.2	Disadvantages and Limitations of PBT	55
2.13.3	Typical Applications of PBT	55
2.14	Polyethylene Terephthalate (PET)	56
2.14.1	Advantages of PET	58
2.14.2	Disadvantages and Limitations of PET	59
2.14.3	Typical Applications of PET	59
2.15	Polyethylene (PE)	59
2.15.1	Advantages of PE	61
2.15.2	Disadvantages and Limitations of PE	61
2.15.3	Typical Applications of PE	62
2.16	Ethylene Vinyl Acetate (EVA)	63
2.17	Ethylene N-Butyl Acrylate (ENBA)	63
2.18	Ethylene Methyl Acrylate (EMA)	64
2.19	Ethylene Ethyl Acrylate (EEA)	64
2.20	Ultrahigh Molecular Weight Polyethylene (UHMWPE)	64
2.21	Metallocene Polyethylene (MPE)	64
2.22	Polytetrafluoroethylene (PTFE)	65
2.22.1	Advantages of PTFE	68
2.22.2	Disadvantages and Limitations of PTFE	68
2.22.3	Typical Applications of PTFE	69
2.23	Polyphenylene Sulfide (PPS)	70
2.23.1	Advantages of PPS	71
2.23.2	Disadvantages and Limitations of PPS	71
2.23.3	Typical Applications of PPS	72
2.24	Polypropylene (PP)	72
2.24.1	Advantages of PP	74

2.24.2	Disadvantages and Limitations of PP	74
2.24.3	Typical Applications of PP	75
2.25	Polystyrene (PS)	76
2.25.1	Advantages of PS	77
2.25.2	Disadvantages and Limitations of PS	77
2.25.3	Typical Applications of PS	78
2.26	Polysulfone (PSU)	78
2.26.1	Advantages of PSU	80
2.26.2	Disadvantages and Limitations of PSU	80
2.26.3	Typical Applications of PSU	80
2.27	Polyvinyl Chloride (PVC)	81
2.27.1	Advantages of PVC	82
2.27.2	Disadvantages and Limitations of PVC	83
2.27.3	Typical Applications of PVC	83
2.28	Styrene Acrylonitrile (SAN)	84
2.28.1	Advantages of SAN	85
2.28.2	Disadvantages and Limitations of SAN	85
2.28.3	Typical Applications of SAN	85
2.28.4	Typical Applications for OSA and ASA	86
3	Thermoplastic Elastomers (TPE)	87
3.1	Advantages of TPE	87
3.2	Disadvantages of TPE	88
3.3	Thermoplastic Elastomer Families	89
3.4	Thermoplastic Polyurethane Elastomer (TPU)	90
3.4.1	Advantages of TPU	92
3.4.2	Disadvantages and Limitations of TPU	92
3.4.3	Typical Applications of TPU	93
3.5	Styrenic Block Copolymer (SBS)	93
3.5.1	Advantages of SBS	95
3.5.2	Disadvantages and Limitation of SBS	95
3.5.3	Typical Applications of SBS	95
3.6	Polyolefin Thermoplastic Elastomer (TPO)	96
3.6.1	Advantages of TPO	98
3.6.2	Disadvantages and Limitations of TPO	99
3.6.3	Typical Applications of TPO	99
3.7	Thermoplastic Vulcanizate (TPV)	100
3.7.1	Advantages of TPV	102
3.7.2	Disadvantages and Limitations of TPV	102
3.7.3	Typical Applications of TPV	102
3.8	Melt Processible Rubber (MPR)	103
3.8.1	Advantages of MPR	105
3.8.2	Disadvantages and Limitations of MPR	105
3.8.3	Typical Applications of MPR	105
3.9	Block Copolyester Thermoplastic Elastomer	106
3.9.1	Advantages	109
3.9.2	Disadvantages and Limitations	110
3.9.3	Typical Applications	110

3.10	Polyamide Thermoplastic Elastomer	111
3.10.1	Advantages	113
3.10.2	Disadvantages and Limitations	113
3.10.3	Typical Applications	114
4	Liquid Injection Molding Silicone (LIM®)	115
4.1	LIM® Silicone Processing	116
4.1.1	Liquid Components Feeding System	116
4.1.2	Injection Molding Machine Modifications	117
4.1.3	LIM® Mold Requirements	117
4.1.4	LIM® Mold Design Recommendations	118
4.2	Advantages of LIM®	118
4.3	Disadvantages and Limitations of LIM®	119
4.4	Typical Applications of LIM®	119
5	Industrial Thermoset Polymers	121
5.1	Polyester Alkyd (PAK)	123
5.1.1	Advantages of PAK	124
5.1.2	Disadvantages and Limitations of PAK	124
5.1.3	Typical Applications of PAK	124
5.2	Diallyl Phthalate/Isophthalate (DAP, DAIP)	125
5.2.1	Advantages of DAP	126
5.2.2	Disadvantages and Limitations of DAP	126
5.2.3	Typical Applications of DAP	127
5.3	Melamine Formaldehyde (MF)	127
5.3.1	Advantages of MF	128
5.3.2	Disadvantages and Limitations of MF	129
5.3.3	Typical Applications of MF	129
5.4	Cellulose Ester	129
5.4.1	Advantages of Cellulose Ester	129
5.4.2	Disadvantages and Limitations of Cellulose Ester	130
5.4.3	Typical Applications of Cellulose Ester	130
5.5	Cyanate	131
5.5.1	Advantages of Cyanate	133
5.5.2	Disadvantages and Limitations of Cyanate	134
5.5.3	Typical Applications of Cyanate	134
5.6	Epoxy (EP)	134
5.6.1	Advantages of Epoxy	136
5.6.2	Disadvantages and Limitations of Epoxy	137
5.6.3	Typical Applications of Epoxy	137
5.7	Phenol Formaldehyde (Phenolic, PF)	137
5.7.1	Advantages of Phenolics	139
5.7.2	Disadvantages and Limitations of Phenolics	140
5.7.3	Typical Applications of Phenolics	140
5.8	Polybutadiene (PB)	141
5.8.1	Advantages of PB	141
5.8.2	Disadvantages and Limitations of PB	141
5.8.3	Typical Applications of PB	141

5.9 Bismaleimide (BMI)	142
5.9.1 Advantages of BMI	143
5.9.2 Disadvantages and Limitations of BMI	143
5.9.3 Typical Applications of BMI	143
5.10 Unsaturated Polyester (UP)	143
5.10.1 Advantages of UP	146
5.10.2 Disadvantages and Limitations of UP	146
5.10.3 Typical Applications of UP	146
5.11 Polyimide (PI)	147
5.11.1 Advantages of PI	148
5.11.2 Disadvantages and Limitations of PI	148
5.11.3 Typical Applications of PI	149
5.12 Polyxylene	150
5.12.1 Advantages of Polyxylene	150
5.12.2 Disadvantages and Limitations of Polyxylene	150
5.12.3 Typical Applications of Polyxylene	150
5.13 Polyurethane (PUR)	151
5.13.1 Advantages of PUR	154
5.13.2 Disadvantages and Limitations of PUR	154
5.13.3 Typical Applications of PUR	155
5.14 Silicone (Si)	155
5.14.1 Advantages of Si	156
5.14.2 Disadvantages and Limitations of Si	156
5.14.3 Typical Applications of Si	157
5.15 Urethane Hybrid	158
5.15.1 Reaction Injection Molding (RIM)	159
5.15.2 SRIM Processing	159
5.15.3 Advantages of Urethane Hybrid	160
5.15.4 Disadvantages and Limitations of Urethane Hybrid	160
5.15.5 Typical Applications of Urethane Hybrid	160
5.16 Vinyl Ester (BPA)	161
5.16.1 Advantages of this Process	163
5.16.2 Advantages of Vinyl Ester	163
5.16.3 Disadvantages and Limitations of Vinyl Ester	164
5.16.5 Typical Applications of Vinyl Ester	164
Selected References	165
Appendix	167
Acronyms for Polymeric Materials	167
Common Acronyms	169
Process Acronyms	169
Reinforcement and Filler Acronyms	170
English and Metric Units, Conversion Guide	171
Subject Index	173
About the Author	179