

# Contents

<b>Editorial Advisory Board</b> .....	<b>V</b>
<b>The Authors</b> .....	<b>VII</b>
<b>Preface</b> .....	<b>IX</b>
<b>Contents</b> .....	<b>XI</b>
<b>1 Introduction</b> .....	<b>1</b>
1.1 Overview of the Polymer Blend Technology .....	1
1.1.1 Demixing in Polymer Blend Systems .....	1
1.2 Different Types of Miscible Polymer Blend Systems .....	2
1.2.1 PMMA/SAN Blend Systems .....	2
1.2.2 PS/PVME Blend Systems .....	3
1.2.3 PVDF/PMMA Blend Systems .....	5
1.3 Immiscible Polymer Blend Systems .....	5
1.3.1 Polypropylene (PP)-Based Blend Systems .....	5
1.3.2 PE-Based Polymer Blend Systems .....	6
1.3.3 PC-Based Polymer Blend Systems .....	6
1.4 Biobased Polymer Blend Systems .....	8
1.5 Industrial Significance and Commercial Applications of Different Polymer Blend Systems .....	9
1.6 Conclusions .....	10

<b>2</b>	<b>Phase Separation, Heterogeneous Behavior and Prevention of Phase Separation</b> .....	<b>15</b>
2.1	Basic Concept of Polymer Blends .....	15
2.2	Theories of Polymer Solutions .....	16
2.2.1	The Ideal Solutions of Small Molecules .....	16
2.2.2	Non-ideal Polymer Solutions .....	17
2.3	Mechanism of Phase Separation .....	20
2.4	Different Types of Morphologies .....	22
2.5	Influence of Compatibilizers on Morphology and the Phase Separation Behavior of Polymer Blends .....	27
2.5.1	Influence of Reactive Compatibilization .....	27
2.5.2	Particle-Induced Compatibilization .....	29
2.5.3	Role of Janus Hybrid Particles .....	31
2.6	Conclusions .....	36
<b>3</b>	<b>Crystallization and Melting Kinetics of Phase Separated Polymer Blends</b> .....	<b>41</b>
3.1	Introduction .....	41
3.2	Crystallization Kinetics from Melt .....	41
3.3	Theories of Nucleation and Growth .....	44
3.3.1	Homogeneous Nucleation .....	44
3.3.2	Heterogeneous Nucleation .....	46
3.3.3	Spherulite Growth and Fold Surface Free Energy .....	47
3.4	Crystallization Behavior (Isothermal and Non-isothermal) of Polymer Blends .....	49
3.5	Influence of Fillers on the Morphology and Crystalline Structure of Binary Polymer Blends .....	53
3.6	Impact of Compatibilizers on the Crystallization Morphology and Crystallization Rate of Polymer Blends .....	55
3.7	Conclusions .....	58
<b>4</b>	<b>Theoretical Studies of Phase Separation in Polymer Blends</b> ..	<b>61</b>
4.1	Introduction .....	61
4.2	Flory-Huggins Theory .....	62
4.3	Chad-Hilliard-Cook Theory .....	73

4.4	Landau–Ginzburg Theory .....	76
4.5	Conclusions .....	79
<b>5</b>	<b>Processing of Phase-Separated Blends .....</b>	<b>83</b>
5.1	Introduction .....	83
5.2	Processing Methods .....	83
5.2.1	Melt Compounding .....	83
5.2.2	Solution Blending .....	87
5.2.3	Latex Mixing .....	91
5.2.4	Interpenetrating Polymer Networks (IPNs) .....	93
5.2.5	Graft Copolymerization .....	96
5.2.6	In Situ Polymerization .....	98
5.2.7	Mill Mixing .....	99
5.3	Characterization of Phase-Separated Polymer Blends .....	101
5.4	Conclusions .....	105
<b>6</b>	<b>Experimental Approaches for the Evaluation of Phase Separation Process in Polymer Blends .....</b>	<b>111</b>
6.1	Introduction .....	111
6.2	Evaluation of Phase Separation Behavior in Polymer Blends by DSC ..	111
6.3	Evaluation of Phase Separation Behavior in Polymer Blends by DMA ..	113
6.4	Evaluation of Phase Separation Behavior in Polymer Blends by Rheology .....	116
6.5	Evaluation of Phase Separation Behavior in Polymer Blends by Broadband Dielectric Relaxation Spectroscopy .....	118
6.6	Evaluation of Phase Separation Behavior in Polymer Blends by Transmission Electron Microscope .....	121
6.7	Evaluation of Phase Separation Behavior in Polymer Blends by Scanning Electron Microscope .....	123
6.8	Evaluation of Phase Separation Behavior in Polymer Blends by Optical Microscope .....	124
6.9	Evaluation of Phase Separation Behavior in Polymer Blends by Atomic Force Microscope .....	126
6.10	Conclusions .....	129

<b>7</b>	<b>Factors Influencing Phase Separation in Partially Miscible Polymer Blends</b> .....	<b>133</b>
7.1	Introduction .....	133
7.2	Processing Techniques .....	134
7.2.1	Solution Mixing and Film Casting .....	134
7.2.2	Doctor Blade .....	137
7.2.3	Electrospinning .....	140
7.2.4	Spin Coating .....	143
7.2.5	Compression Molding .....	148
7.2.6	Incorporation of Nanoparticles .....	149
7.3	Conclusions .....	159
<b>8</b>	<b>Interfacial Modification of Immiscible Polymer Blends</b> .....	<b>165</b>
8.1	Introduction .....	165
8.2	Block Copolymers .....	166
8.3	Janus Nanoparticles .....	167
8.4	Compatibilization by Nanoparticles .....	171
8.4.1	Graphene Oxide .....	171
8.4.2	Carbon Nanotubes .....	172
8.5	Conclusions .....	173
<b>9</b>	<b>Applications of Immiscible Polymer Blends</b> .....	<b>177</b>
9.1	Introduction .....	177
9.2	Gas and Moisture Barrier Applications .....	178
9.3	Gas Sensing Applications .....	180
9.4	Membranes for Water Remediation .....	182
9.5	Electromagnetic Interference Shielding Materials .....	183
9.6	Conclusions .....	191
	<b>Index</b> .....	<b>195</b>