

Contents

Preface	IX
1. UV Degradation and Weathering of Polymers, Blends and Composites	1
<i>Anish Varghese and Vikas Mittal</i>	
1.1 Introduction	1
1.2 UV Degradation of Polymeric Materials	2
1.2.1 UV Degradation of Polypropylene (PP) based Materials	2
1.2.2 UV Degradation of Polyethylene (PE) based Materials	10
1.2.3 UV Degradation of Epoxy based Materials	15
1.2.4 UV Degradation of Polyester Resin based Materials	17
1.2.5 UV Degradation of Polyurethanes (PUs) based Materials	19
1.2.6 UV Degradation of Polycarbonate (PC) based Materials	20
1.2.7 UV Degradation of Vinyl Ester Resin (VER) based Materials	20
1.2.8 UV Degradation of Poly(vinyl alcohol) (PVA) based Materials	21
1.2.9 UV Degradation of Other Polymers and Copolymers	22
1.3 Conclusions	25
References	25
2. UV Degradation of Polymer Coatings	35
<i>Haleema Saleem and Vikas Mittal</i>	
2.1 Introduction	35
2.2 Mechanism of UV Degradation	38
2.3 Different Polymer Coatings Systems	40
2.3.1 PU Coatings	40
2.3.2 Acrylic Coatings	41
2.3.3 Epoxy Coatings	44
2.3.4 Polyester Coatings	45

2.3.5	Silicone Coatings	46
2.4	Summary and Outlook	46
	References	46
3.	Biodegradation Properties of Melt Processed PBS/Chitosan Bio-nanocomposites with Silica, Silicate and Thermally Reduced Graphene	53
	<i>Fakhruddin Patwary, Nadejda Matsko and Vikas Mittal</i>	
3.1	Introduction	53
3.2	Experimental	55
3.2.1	Materials	55
3.2.2	Preparation of Nanocomposites	55
3.2.3	Soil Burial Test	56
3.2.4	Characterization Techniques	56
3.3	Results and Discussion	58
3.4	Conclusions	72
	References	74
4.	Polyethylene: Degradation and Stabilization	79
	<i>Aya Shiraz Shukri AlMasri, Maram Awad, Sawsan Ali and Vikas Mittal</i>	
4.1	Introduction	79
4.1.1	Historical Facts	79
4.1.2	Overview of Polyethylene Grades	79
4.2	Degradation and Stabilization of PE and Composites	83
4.2.1	UV Radiation and Photo-oxidation Degradation	84
4.2.2	Thermal Degradation	88
4.2.3	Chemical Degradation	92
4.2.4	Fire Degradation	92
4.2.5	Mechanical Degradation	93
4.2.6	Water Hydrolytic Degradation	94
4.2.7	Microbiological Degradation	94
4.3	Conclusions	95
	References	95
5.	Epoxy: Understanding Degradation and Stabilization	99

Hyemin Lee, Zhou He, Yuting Li and Vikas Mittal

5.1	Introduction	99
5.2	Understanding the Degradation and Stabilization of Epoxy	100
5.2.1	Thermal Degradation	100
5.2.2	Fire Retardation	103
5.2.3	UV Degradation	104
5.2.4	Epoxy Stabilization	104
5.3	Conclusions	107
	References	107
6.	Effect of Hygrothermal Ageing on Mechanical, Thermal, Structural and Morphological Properties of Polypropylene and its Blends with Different Copolymers	113
	<i>Anish Varghese and Vikas Mittal</i>	
6.1	Introduction	113
6.2	Experimental	115
6.2.1	Materials	115
6.2.2	Fabrication of PP/Copolymer Blends	116
6.2.3	Hygrothermal Ageing of Samples	116
6.2.4	Characterization	117
6.3	Results and Discussion	119
6.4	Conclusions	136
	References	136
7.	Hygrothermal Ageing of Isotactic Polypropylene and Impact Polypropylene Copolymers: A Comparison of Mechanical, Thermal, Structural and Morphological Properties	143
	<i>Anish Varghese and Vikas Mittal</i>	
7.1	Introduction	143
7.2	Experimental	145
7.2.1	Materials	145
7.2.2	Preparation of Samples	145
7.2.3	Hygrothermal Ageing of Samples	146
7.2.4	Characterization of Unaged and Aged Samples	146

VIII		<i>Contents</i>
	7.3 Results and Discussion	148
	7.4 Conclusions	158
	References	159
8.	Effect of Accelerated UV Weathering on the Properties of Isotactic Polypropylene and Impact Polypropylene Copolymers	165
	<i>Anish Varghese and Vikas Mittal</i>	
	8.1 Introduction	165
	8.2 Experimental	167
	8.2.1 Materials	167
	8.2.2 Sample Preparation	167
	8.2.3 Photo-oxidation	167
	8.2.4 Characterization	168
	8.3 Results and Discussion	169
	8.4 Conclusions	182
	References	182
	Index	191