

Contents

Foreword by James Guillet	V
Preface to the English Language Edition	VI
Preface to the Russian Edition	VI
Introduction	XIII
PART ONE Photoconversion of Polymers	1
Chapter 1 Photophysical Processes	3
Energy Transfer and Migration in Polymers	7
Energy Migration in the Singlet State	9
Energy Migration in Triplet Levels	15
The Effect of Concentration and Distribution of Chromophore Groups upon Photostability.....	20
References	24
Chapter 2 Some Characteristics of Photochemical and Dark Reactions in Polymer Matrices	27
Effect of Properties of Polymer Matrices on Rate of Reaction	27
Peculiarities of Reaction Kinetics in Polymer Matrices ...	33
Dark Reactions	33
Photochemical Reactions	41
Leveling (Grading) of Stabilizer Reactivity in Solid Polymers	52
Stabilization of Labile Intermediate Products in Polymer Matrices and Their Secondary Photoreactions	65
References	75
Chapter 3 Photooxidation of Polypropylene	79
The Mechanism and Kinetics of Photooxidation	80
The Effect of Sensitizers on Photooxidation Kinetics	84
The Mechanism of Photoinitiation	97

	The Photoinitiating Effect on Oxygen	97
	Phototransfer of Charge	98
	Two-Photon Reactions of Aromatic Compounds	101
	One-Photon Reactions of Polynuclear Aromatic Hydro- carbons	107
	References	110
Chapter 4	Photoaging of Aliphatic Polyamides	113
	Primary Photoprocesses of Aliphatic Polyamides and Model Compounds	113
	Primary Photophysical Processes	113
	Primary Photochemical Processes	119
	Products of Photoaging in Polyamides	121
	Products of Photolysis	122
	Photooxidation Products	123
	Formation of Radicals in Polyamides and in Model Compounds	125
	The Mechanism of Photoaging in Polyamides	127
	Mechanism of Photolysis	127
	Photooxidation of Reactions of Low-Molecular-Weight Substances that Model Polyamides	129
	The Influence of Experimental Conditions on the Photo- oxidation Process	131
	Sequence of Formation of Photooxidation Products	136
	Mechanisms of Photooxidation Product Formation	140
	Tensile Strength Reduction	145
	Kinetics of Photooxidation	147
	The Effect of Additives on Photoaging	150
	References	152
Chapter 5	Singlet Oxygen and the Photooxidation of Polymers	162
	Reactions of Singlet Oxygen with Polymers and with Model Compounds	166
	Effect of Singlet Oxygen Quenchers upon the Photooxidation Rate of Polymers	169

	Effect of Singlet Oxygen Concentration on the Rate of Photooxidation	172
	References	185
PART TWO	Light Stabilization of Polymers	189
Chapter 6	Protective Mechanisms of Photostabilizers in Model Systems	191
	Screening	193
	Inhibition of Photosensitized Oxidation Processes in Low-Molecular-Weight Compounds.....	196
	Inhibition of Photodegradation Processes in Low-Molecular-Weight Ketones	206
	Efficiency of Photostabilizers in Model Oxidation Reactions.....	209
	References	213
Chapter 7	Physical Mechanisms of Inhibition of the Phototransformation Processes of Polymers in Solution	215
	Polymethyl Methacrylate	215
	Polymers Containing Ketone Groups	218
	Photosensitization by Energy Transfer	223
	References	227
Chapter 8	Physical Mechanisms of Inhibition of the Phototransformation Processes of Solid Polymers	229
	The Screening Mechanism	229
	The Quenching Mechanism	242
	Polystyrene	244
	Polymers Containing Ketone Groups	254
	References	258

Chapter 9	Photostability of UV Absorbers	260
	Photochemical Properties of Benzophenone	261
	Photoconversion of 2-Alkyl Substituted Derivatives of Aromatic and Alkylaromatic Ketones	269
	The Effect of Solvents and Substituents on Reactivity of Aromatic and Alkylaromatic Ketones	276
	Intermolecular Photoreduction Reactions	276
	Photodecay in a Norrish Type II Reaction	280
	Light Stability in 4-Hydroxy and 4-Amino Derivatives of Aromatic and Alkylaromatic Ketones	286
	Light Stability of 2-Hydroxy and 2-Amino Derivatives of Aromatic and Alkylaromatic Ketones	292
	Mechanism of Energy Dissipation in 2-Hydroxybenzophenones	294
	Effect of a Solvent on the Luminescence and Reactivity of 2-Hydroxybenzophenones	299
	Photostability of Various Classes of Compounds Containing Carbonyl Groups	303
	Photostability of Some Anthraquinone Derivatives.....	306
	Photostability of Some Benzanthrone Derivatives	313
	Photostability of Nitrogen Compounds	318
	Photostability of Benzotriazoles	318
	Photostability of Some Other Nitrogen Compounds	322
	Effect of Acid-Base and Donor-Acceptor Interactions on the Deactivation of Electron-Excited States	332
	References	341
Chapter 10	Protective Action of Some Photostabilizers	348
	Photostabilizers that Take Part in a Fries Photorearrange- ment	348
	High-Molecular-Weight UV Absorbers	365
	Singlet Oxygen Quenchers	376
	Kinetics of Oxidation by Singlet Oxygen	376
	Efficiency of Quenchers in Liquid Phase Systems	379
	The Quenching Mechanism	391
	Chemical Conversion of Quenchers	396
	Phenols	405

Synergism	417
Sterically Hindered Piperidines and Nitroxyl Radicals	420
Sterically Hindered Piperidines	420
Stable Nitroxyl Radicals	432
Metalloorganic Compounds.....	437
References	449
Subject Matter Index	461