

Contents

Preface vii

Acknowledgments ix

Chapter 1 Background on Polymer-Layered Silicate and Silica Nanocomposites 1

Introduction 2

1.1. Layered silicate 3

1.2. Silica 21

1.3. Physical properties of layered silicate and silica 29

1.4. Polymers and polymerizations 44

1.5. Preparation and technology for nanocomposites 52

1.6. Recent phenomena in polymer-silicate and silica nanocomposites 62

1.7. Prospect 63

References 65

Chapter 2 Modification and Dispersion of Silicate and Silica 69

Introduction 70

2.1. Modification of silicate 70

2.2. Silica modification 84

2.3. Melt intercalation 100

2.4. Intercalation in media 105

2.5. Modification particles for polymerization 107

References 117

Chapter 3 Polymer-Layered Silicate and Silica Nanocomposites 119

Introduction 120

3.1. PA-silicate nanocomposites 120

3.2. PEO-silicate nanocomposites 135

3.3. Polyolefin-silicate nanocomposite 155

3.4. Polyester-silicate nanocomposite 172

3.5. Polyaniline-silicate nanocomposites 190

3.6. Other kinds of polymer-inorganic nanocomposites 197

3.7. Polymer-silica nanocomposites 201

References 206

Chapter 4 Morphology, Assembly and Properties 211

Introduction 212

4.1. Nanostructure and morphology 212

4.2. Crystallization 228

4.3. Thermal properties 237

4.4. Mechanical properties 243

4.5. Special properties of nanocomposites 246

4.6. Functional properties by nanoparticle assemble and doping 256

4.7. Rheology and dynamic behavior 263

4.8. Nucleation and order 265

References 271

Chapter 5 Characterization and Techniques 275

Introduction 276

5.1. Particle Characterization 276

5.2. Structure and properties 278

5.3. Characterization techniques for structure and properties 285

5.4. Multiple structures of nanocomposites 308

5.5. Relationship between structure and property 310

5.6. Nanoeffects in nanocomposites 312

References 326

Chapter 6 Applications and Products 329

Introduction 330

6.1. Applications of nanocomposites 330

6.2. Products of nanomaterials 368

6.3. Nanocomposites and traditional industries 378

6.4. Prospects 384

References 387

Subject Index 389