
Contents

Preface.....	ix
Author Biographies	xi

Chapter 1	Nanomaterials-Based Sustainable Pigments	1
1.1	Introduction	1
1.2	Core–Shell NP: Synthesis Approach and Importance	2
1.3	Core–Shell Synthesis Methods.....	4
1.4	Materials-Based Shell Part.....	10
1.5	Efficiency and Test Methods	10
1.6	Applications of Core–Shell Pigments	15
1.7	Summary	16
	References	17

Chapter 2	Modification of Cement-Based Materials with Nanoparticles	23
2.1	Introduction	23
2.2	Nanotechnology and Nanomaterials	25
2.3	Nanomaterials-Modified Cement Binder	27
2.4	Sustainability Performance	33
2.5	The Interfacial Transition Zone (ITZ).....	35
2.6	Carbon Nanomaterials Applied in Cementitious Composites	41
2.7	Nanomaterials-Based Geopolymer Concrete	44
2.8	Effects of Nanomaterials on Alkali-Activated Binders.....	47
2.9	Summary	52
	References	52

Chapter 3	Nano-Enhanced Phase-Change Materials	67
3.1	Introduction	67
3.2	Nano-Metal Enhancer	68
3.3	Nano-Metal Oxide Enhancer.....	73
3.4	Nanocarbon Enhancer	77
3.5	Summary	83
	References	84

Chapter 4	Preparation and Properties of Nanopolymer Advanced Composites	87
4.1	Introduction	87
4.2	Compatibilisation in Polymer Nanocomposites	88

4.2.1	In Situ Polymerisation	88
4.2.2	Solution Blending	89
4.2.3	Melt Blending	90
4.3	Nanopolymer Fibre-Reinforced Composites	91
4.4	Nanopolymer Fibre-Reinforced Sandwich Composites	93
4.5	Nanopolymers and Their Applications	94
4.6	Environmental Applications	95
4.6.1	Heavy Ion Removal	96
4.6.2	Solar Energy	97
4.7	Polymeric Nanofibres as Sensors	97
4.8	Summary	99
	References	99

Chapter 5 Nanotechnology-Based Smart Glass Materials..... 103

5.1	Introduction	103
5.2	Nanotechnology	104
5.3	Self-Cleaning Glass	106
5.4	Hydrophilic Coating	107
5.5	Anti-Reflective Coating	108
5.6	Photocatalytic Activity of TiO_2	109
5.7	Fabrication of Self-Cleaning Glass	110
5.8	SiO_2 - TiO_2 Coating	110
5.9	Nanomaterial-Based Solar Cool Coatings	111
5.9.1	Metal-Based Nanoadditives	112
5.9.2	Metal Oxide-Based Nanoadditives	112
5.9.3	Absorption-Based Nanoadditives	115
5.9.4	Metalloid-Based Nanoadditives	115
5.10	Key of Building Applications	116
5.10.1	Gold (Au)	116
5.10.2	Zinc Oxide (ZnO) and Aluminium Zinc Oxide (AZO)	116
5.10.3	Indium Tin Oxide (ITO) and Antimony Tin Oxide (ATO)	117
5.10.4	Vanadium Oxide (VO_2)	119
5.10.5	Tungsten Oxide (WO_3) and Alkali Metal-Doped Tungsten Oxide (AxWO_3)	120
5.11	Summary	122
	References	122

Chapter 6 Air Nano Purification..... 125

6.1	Introduction	125
6.2	Metallic Oxides	127
6.2.1	Titanium Dioxide (TiO_2)	127
6.2.2	Zinc Oxide	132

6.2.3	Nickel Oxide.....	133
6.2.4	Tungsten Trioxide.....	133
6.2.5	Manganese Oxide.....	134
6.2.6	Bi-Based Compounds.....	134
6.2.7	Ag-Based Compounds.....	134
6.2.8	Platinum-Supported Material.....	135
6.2.9	Iridium Particles.....	135
6.3	Carbon-Based Materials.....	136
6.3.1	Carbon-Based.....	136
6.3.2	Graphene and Graphene Oxide (GO).....	136
6.4	Applications on Buildings.....	137
6.4.1	Indoor Air Treatment.....	137
6.4.2	Coating.....	138
6.4.3	Paints.....	139
6.4.4	Construction Materials.....	139
6.5	Summary.....	140
	References.....	140
	Index.....	147