

1. Record Nr.	UNINA9910812376803321
Titolo	Nanocomposites / / edited by Sabu Thomas
Pubbl/distr/stampa	Somerset, N.J., : Wiley-VCH Verlag, 2013
ISBN	9783527652396 3527652396 9783527652372 352765237X 9783527652402 352765240X
Edizione	[1st ed.]
Descrizione fisica	1 online resource (324 p.)
Collana	Polymer composites ; ; v. 2
Altri autori (Persone)	ThomasSabu
Disciplina	620.192
Soggetti	Nanocomposites (Materials) Polymeric composites
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Polymer Composites; Contents; The Editors; List of Contributors; 1 State of the Art - Nanomechanics; 1.1 Introduction; 1.2 Nanoplatelet-Reinforced Composites; 1.3 Exfoliation-Adsorption; 1.4 In Situ Intercalative Polymerization Method; 1.5 Melt Intercalation; 1.6 Nanofiber-Reinforced Composites; 1.7 Characterization of Polymer Nanocomposites; 1.8 Recent Advances in Polymer Nanocomposites; 1.9 Future Outlook; References; 2 Synthesis, Surface Modification, and Characterization of Nanoparticles; 2.1 Introduction; 2.2 Synthesis and Modification of Nanoparticles; 2.2.1 Synthesis of Nanoparticles 2.2.2 Synthesis of Titania Nanoparticles2.2.3 Microwave Synthesis of Magnetic Fe <sub>3</sub> O <sub>4</sub> Nanoparticles; 2.2.4 Magnetic Field Synthesis of Fe <sub>3</sub> O <sub>4</sub> Nanoparticles; 2.2.5 Synthesis of Fe <sub>3</sub> O <sub>4</sub> Nanoparticles without Inert Gas Protection; 2.2.6 Synthesis of ZnO Nanoparticles by Two Different Methods; 2.2.7 Synthesis of Silica Powders by Pressured Carbonation; 2.2.8 MW-Assisted Synthesis of Bisubstituted Yttrium Garnet Nanoparticles; 2.2.9 Molten Salt Synthesis of Bisubstituted Yttrium Garnet Nanoparticles; 2.3 Modification of Nanoparticles; 2.3.1 Surface Modification of ZnO Nanoparticles

2.3.2 Surface Modification of Fe<sub>3</sub>O<sub>4</sub> Nanoparticles 2.3.3 Surface Modification of Silica Nanoparticles; 2.4 Preparation and Characterization of Polymer-Inorganic Nanocomposites; 2.4.1 Nanopolymer Matrix Composites; 2.5 Preparation of Polymer-Inorganic Nanocomposites; 2.5.1 Sol-Gel Processing; 2.5.2 In Situ Polymerization; 2.5.3 Particle In Situ Formation; 2.5.4 Blending; 2.5.4.1 Solution Blending; 2.5.4.2 Emulsion or Suspension Blending; 2.5.4.3 Melt Blending; 2.5.4.4 Mechanical Grinding/Blending; 2.5.5 Others; 2.6 Characterization of Polymer-Inorganic Nanocomposites; 2.6.1 X-Ray Diffraction  
2.6.2 Infrared Spectroscopy 2.6.3 Mechanical Property Test; 2.6.4 Abrasion Resistance Test; 2.6.5 Impact Strength; 2.6.6 Flexural Test; 2.6.7 Others; 2.7 Applications of Polymer-Inorganic Nanocomposites; 2.7.1 Applications of Bi-YIG Films and Bi-YIG Nanoparticle-Doped PMMA; 2.7.1.1 Magneto-Optical Isolator; 2.7.1.2 Magneto-Optical Sensor; 2.7.1.3 Tuned Filter; 2.7.1.4 Magneto-Optical Recorder; 2.7.1.5 Magneto-Optic Modulator; 2.7.1.6 Magneto-Optic Switch; 2.8 Application of Magnetic Fe<sub>3</sub>O<sub>4</sub>-Based Nanocomposites; 2.9 Applications of ZnO-Based Nanocomposites; 2.9.1 Gas Sensing Materials  
2.9.2 Photocatalyst for Degradation of Organic Dye 2.9.3 Benard Convection Resin Lacquer Coating; 2.10 Applications of Magnetic Fluid; References; 3 Theory and Simulation in Nanocomposites; 3.1 Introduction; 3.1.1 Dispersion of Nanoparticles; 3.1.2 Interface; 3.1.3 Crystallization; 3.1.4 Property Prediction; 3.2 Analytical and Numerical Techniques; 3.2.1 Analytical Models; 3.2.2 Numerical Methods; 3.2.3 Multiscale Modeling; 3.3 Formation of Nanocomposites; 3.3.1 Thermodynamics of Nanocomposite Formation; 3.3.2 Kinetics of Nanocomposite Formation; 3.3.3 Morphology of Polymer Nanocomposites  
3.4 Mechanical Properties

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#### Sommario/riassunto

Polymer composites are materials in which the matrix polymer is reinforced with organic/inorganic fillers of a definite size and shape, leading to enhanced performance of the resultant composite. These materials find a wide number of applications in such diverse fields as geotextiles, building, electronics, medical, packaging, and automobiles. This first systematic reference on the topic emphasizes the characteristics and dimension of this reinforcement. The authors are leading researchers in the field from academia, government, industry, as well as private research

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