

Graphene in Composite Materials: Synthesis, Characterization and Applications

By Nikhil Koratkar

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Graphene for polymer, metal and ceramic matrix composites; New mechanical, thermal and electrical data for graphene in engineered materials; Applications in films, coatings and liquid suspensions

---------- Original monograph discusses graphene within the carbon chemistry alternatives available to materials engineers and explains how it is incorporated into polymer-matrix, as well as ceramic- and metal-matrix composite materials. The book shows how different forms of graphene can be synthesized and then added to polymer composites as main or hybrid nanofillers, with a focus on how graphene affects electrical and mechanical properties. Offers the theory and data necessary to design novel graphene-based composites with unique load-bearing, flammability and wear properties. Throughout, the book lists many newly discovered mechanical, thermal and electrical properties of graphene. Emerging uses of graphene in films, coatings and colloidal suspensions (i.e., graphene with liquid matrices) are also investigated.

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Editorial Review

Review
Perhaps the most promising and technologically feasible application of graphene in the nearest term is its use as a nanofiller in bulk composites to improve the mechanical, thermal and electrical properties of polymer, metal and ceramic matrix composites. Koratkar s new book provides a timely and comprehensive review of the state-of-art on this important topic and will be of great interests to industry professionals as well as academics and students. The book details various approaches to produce graphene in bulk quantities including both top-down and bottom-up methods. Then it describes various microscopy and spectroscopy tools that can be used to characterize the structure/properties of graphene. Next the book describes in detail how graphene can be infiltrated in a variety of composite matrices including polymers such as epoxies, structural ceramics such as silicon nitride and metals such as aluminum. The resulting improvements in mechanical, thermal and electrical properties as a function of the graphene loading are given along with basic mathematical models to predict the performance of these novel materials. The book also describes hierarchical composites obtained by introducing graphene into conventional microfiber reinforced polymer composites which are widely used in the automotive, aerospace, and construction industries. Another very useful feature of the book is that it discusses the synthesis, stability and applications of graphene based colloidal dispersions in liquid matrices. Where ever possible the book compares the performance of graphene with other competing nanofillers such as carbon nanotubes, fullerenes and nanoparticles to give readers a clear perspective on the advantages and the limitations of graphene in composite materials. Overall the book is the first comprehensive review of this important and fast emerging frontier area of graphene research and is written by a world renowned expert on this topic. I think the book will find widespread use in industry, academia, and government research laboratories. --Hui-Ming Cheng, Professor, Director of Advanced Carbon Division, Shenyang National Laboratory for Materials Science Institute of Metal Research, Chinese Academy of Sciences

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