

Book Review: “Polymer Nanocomposites – Processing, Characterization, and Applications”

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Polymer Nanocomposites -Processing, Characterization, and Applications, authored by Dr. Joseph Koo, is an outgrowth of a popular tutorial series at the SAMPE conferences, tailored for an audience mostly from the composites industry. The author has effectively reduced the lecture notes into a monograph covering the subject matter in a manner often used for composite materials books, wherein the topics are presented sequentially in the following order: reinforcements, matrix, characterization methods, properties and applications. This book is clearly written with a significant amount of experimental data supplemented with a good collection of references. It concentrates on the technological aspects of nanoparticle filled polymeric materials with a strong focus on the high temperature characteristics of the nanocomposites. This is evident by the fact that nearly 50% of the book is devoted to the flammability and ablation behavior of nanocomposites required for various applications. This book is suitable for use as a reference for practitioners in the field and as supplementary reading for an introductory level course in nanocomposites.

This book is organized into eight (8) chapters and each includes a list of references, some of them are quite extensive. In chapter 1, after an introduction to the historical development of nanotechnology the significance of nano-dimensions is explained and defined. The author went on to classify polymer nano materials and describe the organization of the book. In Chapter 2, an overview of nanoparticles is

presented. Specifically the origin, structure, processing, properties, and applications of nanoclay, carbon nanotube, polyhedral oligomeric silsesquioxane (POSS), carbon nanotube, nanosilica, nano aluminum oxide, nanotitanium oxide are described. In Chapter 3, a brief description of thermoplastic, thermoset and elastomeric nanocomposites is given, again with an extensive listing of references. The various solid and liquid polymer processing methods for the nanocomposites are described in Chapter 4. The solid state processes covered include solution intercalation, melt intercalation, and roll milling whereas the liquid process includes in-situ polymerization, emulsion polymerization and high-shear mixing. In Chapter 5, the various characterization methods for polymer nanomaterials are described. These methods include X-ray diffraction; transmission electron microscopy; energy-dispersive x-ray spectroscopy; small-angle X-ray scattering; cone calorimetry; and mass loss calorimetry. In Chapter 6, the properties and performance of nanostructured polymeric materials are described. Specifically the physical, mechanical, and thermal properties of selected thermoplastic, thermoset, and elastomeric nanocomposites are presented using nylon 6, epoxy, and polyolefin respectively as examples. Chapter 7 provides an extensive coverage of nanocomposites for high-temperature applications with a special focus on flame retardant materials and ablative materials. The flammability and ablative performance of thermal plastic, thermoset, and elastomeric nanocomposites are detailed for various applications ranging from flame resistant cable jacket; to rocket nozzles; to insulation materials for rocket propulsion systems. A rich collection of references is also provided in this chapter. In Chapter 8, the book concludes with a review of the current status and future trend of nanotechnology in terms of research funding, research output, publications, patents and area of research focus. Some examples of commercial applications of nanotechnology are used to illustrate the current and future opportunities. The issues of

environmental impact, health and safety concern relative to nanotechnology are also discussed.

The information presented is current through early 2006. Nevertheless, with a strong coverage of the thermal properties of nanocomposites, it remains one the better background publications on this topic.

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