Perspective

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Electrical Propulsion to Integrated Electrical and Electronic Power Systems

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Description

Different organophilic layered silicates and a modified hydrotalcite were used as functional nanofillers for thermoplastic and thermosetting polymers. Polyamide 6 (PA6) and poly(butylene terephthalate) silicate nanocomposites were prepared by melt compounding using a twin-screw extruder. The morphology of the materials was investigated by transmission electron microscopy and small-angle X-ray scattering, and was found to be characterized by homogeneous dispersion of high aspect ratio silicate layers in the polymer matrix. The PA6 nanocomposite displayed excellent thermo-mechanical properties at low filler loadings and improved barrier properties. Epoxy nanocomposites have also been prepared and characterized with regard to their morphology and their water vapor permeability.

Electric Power

Discarded electrical and electronic products (often called e-waste) is one of the fastest growing waste streams and it has been estimated that these items already constitute 8% of municipal waste (Widmer et al., 2005). The increasing volumes of e-waste, in combination with the complex composition of these items and the resulting difficulties in treating them properly, are causes of concern. The hazardousness of e-waste is well recognized, but the knowledge on these hazards and the resulting risks associated with different treatment options is currently fragmented. Therefore, a survey of the available scientific literature was conducted in order to gather the hard data on workplace and environmental pollution, human exposure to chemicals and resulting adverse effects due to recycling, incineration and landfill disposal of e-waste. This review paper summarizes the current knowledge on these issues, identifies knowledge gaps and points out key areas where further research would be beneficial. The paper begins by an overview of the components and substances that are frequently found in e-waste and that may be of concern from an environmental and health perspective. It then moves onto reviewing first the current situation on e-waste treatment in developed countries and the knowledge on associated risks, and second the conditions in developing countries. A concluding section highlights some of the key findings of the study and makes recommendations on future research.

Power Electronic Converters

Electrical and electronic equipment can contain a large number of hazardous substances, including heavy metals (e.g., mercury, cadmium, lead, etc.), flame retardants (e.g., pentabromophenol, polybrominated diphenyl ethers (PBDEs), tetrabromobisphenol-A (TBBPA), etc.) and other substances. Due to the presence of these substances, e-waste is generally considered as hazardous waste, which, if improperly managed, may pose significant human and environmental health risks. Presence of hazardous substances in electrical and electronic equipment inevitably links its end-of-life disposal with the potential risks to human health and the environment. This section examines the existing e-waste management practices and associated chemical hazards in developed countries. Measurements of the electrical characteristics of radio-frequency (rf) discharges can be subject to large errors due to limitations in the measurement instruments and the stray impedance of the discharge cell. This study reports electrical measurements of argon discharges in the GEC Reference Cell in which special care has been taken to identify and minimize these sources of error. Careful calibration of current and voltage probes was found to be essential. In addition, parasitic impedances in the cell were found to be large, sensitive to minor changes in electrical connections, and not adequately described by simple a priori models. A general technique for characterizing the stray impedance, including an analysis of the propagation of errors, is presented here. This technique assures accurate results with specified uncertainties. Error analysis demonstrated that large gains in the precision of the measurements can be obtained using an inductive shunt circuit. Together, these techniques should improve the utility of electrical measurements for gauging the reproducibility of plasma conditions among rf discharge cells, for testing theoretical results, and for monitoring plasma processing. Electrical propulsion is not a novel concept in marine systems. However, the availability of power electronic converters has proved to be the Key Enabling Technology for electrification of large ships. This paper starts with a summary of EP drives, which led to the birth of all-electric ships. Electric power generation and control systems are then presented, which make it possible to exploit the integrated electrical power system. To ease comprehension of the issues in designing such a system, its conventional design process is given. Then, the reasons that are pushing ahead the

research in the shipboard power systems sector are discussed. The need for research in the design methods area is demonstrated through an overview of the latest results of technological research. Finally, a summary of the most significant results on the design tools research is given, including early stage design, dependable-oriented design, and the improvements achievable through software simulators and hardware-in-the-loop are discussed. The goal of this paper is to demonstrate why research on design methods is as important as a technological one, on the basis of the needs concerning the design, integration, and management of future "integrated electrical and electronic power systems" (power systems with power conversion quota approaching 100%).