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Polymer Composite Materials from Current Status to Future Prospects

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Abstract

A call for novel material, new ideas, applications, and techniques are still and will be challenging all the time. The increased development of science and modern technology allows one to use a high-throughput search for novel materials that could give positive feedback in different areas of life. With increasing demand for high performance materials, the focus of recent researches has been to produce products with enhanced properties at minimal changes in the equipment, process and cost of inputs. The addition of clay minerals or nano-metal oxides to the polymers is to improve the polymer properties, their wide and demand characteristics or desired potential applications by producing the polymer nanocomposites. Scanning and transmission electron microscopy have led to a deeper understanding of polymer nanocomposites, a better account surface topology, structure and morphology.

Keywords: Polycondensation; Tio_2; Core-Shell; Fe_2O_3;Tem; Photocatalytic Activity; AL_2O_3; Kaolinite; Bentonite; Nanocomposites

Introduction

During the last few decades, interest in polymer/clay nanocomposites (PCN) arena has speedily been increasing at an unprecedented level, both in academia and in industry, due to their enhanced physical, chemical, and mechanical properties compared to conventional bare polymers. They have the interesting potential of being a low-cost alternative to high-performance composites for commercial uses in both the packaging and automotive industries. The target of the addition of clay minerals to the polymers is to improve the polymer properties and to obtain polymer/clay nanocomposites with particular characteristics to be suitable for certain applications. Because of the availability, low price, high aspect ratio as well as interfacial interactions and wanted nanostructure, clays can provide dramatic and adaptable improved definite properties at very lower loadings which lead to the highest remaining of polymer original beneficial characteristics. The earliest attempt for the production of nanoparticles appears to have been stimulated by the Toyota scientific research group, where the practical usage of nylon-6-montmorillonite (MMT) nanocomposite has been commercialized [1-3].

Discussion

Various new polymers [4,5] and copolymer/bentonite [6-10], copolymer/kaolinite [11-13], copolymer/pyrogenic silica [14], terpolymer/ bentonite [15,16], terpolymer/kaolinite [17,18] composites have been reported. 3rOne of the composites types is core-shell polymers (CSPs). CSPs have attracted enormous research interest, both from the point of view of fundamental science and technological applications. One in principle forms the core and other forms the shell of the particles. This class of material has the combination of superior properties not possessed by the individual components. The systems might combine the characteristics and properties of both shell and core where the surface properties of the shell are translated to the core, imparting new functionality to the CSP. In continuation of our work, the current studies establishe a novel contribution to the development of new core-shell nanocomposites (CSNCs) based on TiO_2 [19,20], Fe_2O_3 [21], Al_2O_3 [22,23] nanoparticles, which were successfully synthesized by an in situ oxidative chemical polymerization.

Conclusion

An economical approach aimed at producing a series of promising polymer nanocomposites was successfully achieved by in situ polycondensation. Adaptable loads of clay minerals or nano-metal oxides were utilized. The representative spectral characteristics upon incorporation of clay minerals or nano-metal oxides into the polymer sequences were investigated by means of FT-IR and UV-Vis spectroscopy, indicating the fruitful synthesis of the polymer nanocomposites from clay minerals or nano-metal oxides with original polymer. Furthermore, the thermal investigations revealed that clay minerals or nano-metal oxides incorporated into the polymer nanocomposites. Moreover, TEM demonstrated that this novel produced CSNC possessed approximately sphere-shaped core-shell structure with size 17-27 nm. Moreover, photocatalytic efficiency of CSNCs towards MB was substantiated in sunlight. As a result of the synergetic interactions between TiO_2 and the copolymer or terpolymer, the rapid charge isolating then gradual recombining accomplished under sunlight irradiations. Our system considered to have moderate stability, to be one of the good systems, and to have narrow PDI. This technique familiarizes a beneficial, simplistic and inexpensive setup to produce new potential CSNCs obsessed varied functionality. Further research could pave way for studying new polymer nanocomposites.

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