Dynamic Testing Predicts Success of Nanocomposites

The Challenge:

Determine the Effect of Adding Nanoparticles to Commodity Plastics

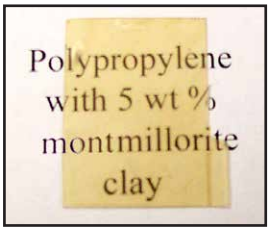
Background

The definition of a nanocomposite material has broadened significantly to include a wide variety of materials made of distinctly dissimilar components and combined at the nanometer scale.

The general class of nanocomposite materials is a fast growing area of research. The properties of these materials depend not only on the properties of their individual components but also on their morphology and interfacial characteristics. This rapidly expanding field is generating many exciting new materials that are intended to yield unusual sets of properties that do not currently exist in commercial systems.

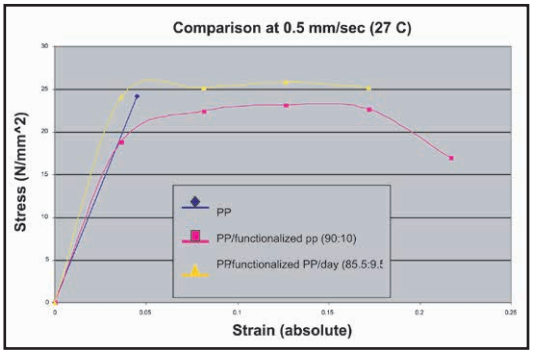
Meeting the Challenge

Dr. Charles Beatty of the University of Florida, Gainesville, is a world leader in in situ reactive polymer processing. He used the ElectroForce® 3200 test instrument with a hot/cold chamber to measure steady state and dynamic material properties on the original commodity plastics, and the modified polymer blends including blends of various nanoparticles such as clay and magnetic ferrite, to determine the extent of modification/enhancement of the desired material property.

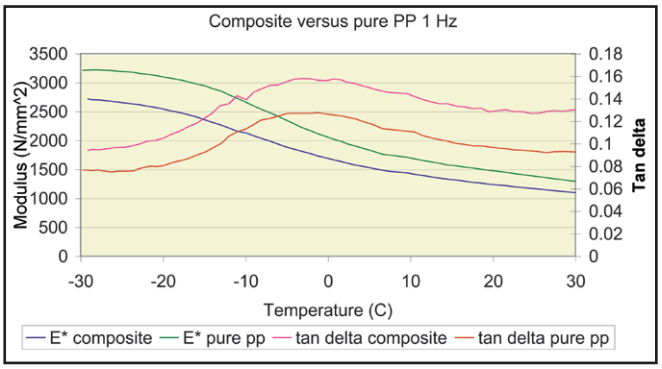


For typical polypropylene/ montmorillonite clay systems, they have produced transparent nanocomposites (although slightly tan colored due to chromophores) that have the usual increase in modulus and tensile strength.

However, the energy to failure for 0.5 mm/s stress-strain tests is more than 300% (3x) greater than the polypropylene matrix, suggesting that the impact measurements will be significantly improved.



DMA tests show differences between the original polypropylene and the nanocomposite for various types of nanoparticles and reactive processes.



The final test of efficacy is the measurement of engineering properties such as impact properties, tensile stress-strain behavior, DMTA and fatigue propertiesafter reprocessing several times to ensure domain interface stability. The ElectroForce 3200 test instrument can be used to determine all of these critical material properties, and more.

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