# Nanocomposites of homopolymers and copolymers with layered silicates and carbon nanotubes

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## ABSTRACT

Nanocomposites of homopolymers and copolymers with layered-smectite clays (organically modified or not), functionalized carbon nanotubes and nanostructured clay-carbon nanotube hybrids were prepared in order to improve the mechanical, thermal and physical properties of the neat polymers.

Various homopolymers and copolymers were used, such as, poly(ethylene terephthalate), polystyrene-*b*-polyisoprene, polystyrene-*b*-polyisoprene-*b*-polystyrene, polystyrene-*b*-poly(dimethylsiloxane), poly(ethylene oxide)-*b*-poly(∈-caprolactone) and polystyrene-*arm*-poly(ethylene oxide)-*arm*-poly(∈-caprolactone). The copolymers were synthesized by anionic polymerization using high-vacuum techniques and were molecularly characterized by size exclusion chromatography.

Carbon nanotubes were developed on clay-supported nickel nanoparticles by the CCVD method. Nanotubes attached on the clay platelets were then chemically modified to create ester groups on their surfaces. The same modification was applied also for the neat carbon nanotubes. Nanocomposites at various polymer to reinforcement loadings (1, 3, 5, 7 wt%) were prepared by solution intercalation.

The final nanocomposites were characterized by powder X-ray diffraction, FT-IR and Raman spectroscopies, thermal analysis, viscometry measurements and scanning electron microscopy. The experiments complemented with mechanical measurements reveal the successful incorporation of the reinforcements in the polymer mass while the presence of the nanoscale reinforcements in the polymer matrices increased the thermal stability and the mechanical properties. Moreover, in the case of clay/carbon nanotubes hybrid, the combination of the 2D nanoclay platelets and the 1D nanotubes, effectively promoted the homogeneous dispersion of the nanostructured hybrid in the polymeric matrix providing outstanding functionalities to the resulting composite materials.