EFFECTS OF THE PROCESSING SEQUENCE AND CRITICAL INTERPARTICLE DISTANCE IN PA6-CLAY/MSEBS NANOCOMPOSITES

Imanol González, José Ignacio Eguiazábal, Jon Nazabal
"POLYMAT"-UPV/EHU, Pº Manuel Lardizabal 3, San Sebastián/Donostia, Spain.
igonzalez@ikasle.ehu.es

Polymer/clay nanocomposites are an active research subject. Within this field, there is increasing interest in the possibility of linking nanocomposite production by clay addition, to blending with a second polymeric component [1-4]. As a consequence, polymeric nanocomposites with a matrix composed of a blend of two thermoplastics, and nanocomposites with a pure polymer matrix toughened by a rubber have been studied. The latter will offer the possibility to overcome the tendency to notch sensitivity and low-notched fracture toughness of nanocomposites by means of rubber modification. In this way, the technique of rubber toughening of brittle polymers (which deform by crazing), later extended to ductile polymers (mostly deformed by shear), could also be used for nanocomposites. This would mean that the only major mechanical property that is not enhanced upon organoclay addition, i.e. toughness, could increase with respect to that of the matrix, and that the decrease in stiffness observed upon rubber addition in toughened blends could be counteracted by the presence of the organoclay.

The aim of this work is to ameliorate the microstructure and performance of the polyamide 6 (PA6)/Clay/maleinized styrene-ethylene-butadiene-styrene triblock copolymer (mSEBS) nanocomposites (PN´s) through a modified processing, as well as to examine the parameters that make the brittle/ductile transition of nanocomposites change. The studied parameters were the rubber and the organoclay contents. The results showed that after the modified processing, the average dispersed particle size decreased with respect to that obtained with a standard processing, and an overall increase in the impact performance occurred (Figure 1). This is attributed to a more effective reaction between the maleic groups of the rubber and the amine end groups of the PA6 when there is no surfactant present in a first processing step. The analysis of the variation of the critical interparticle distance (τ_c) indicates that it depends on the modulus of elasticity of the matrix (i.e. on the organoclay content) (Figure 2) and on the interfacial adhesion, higher modulus of elasticity and higher adhesion leading to smaller τ_c values.

References:

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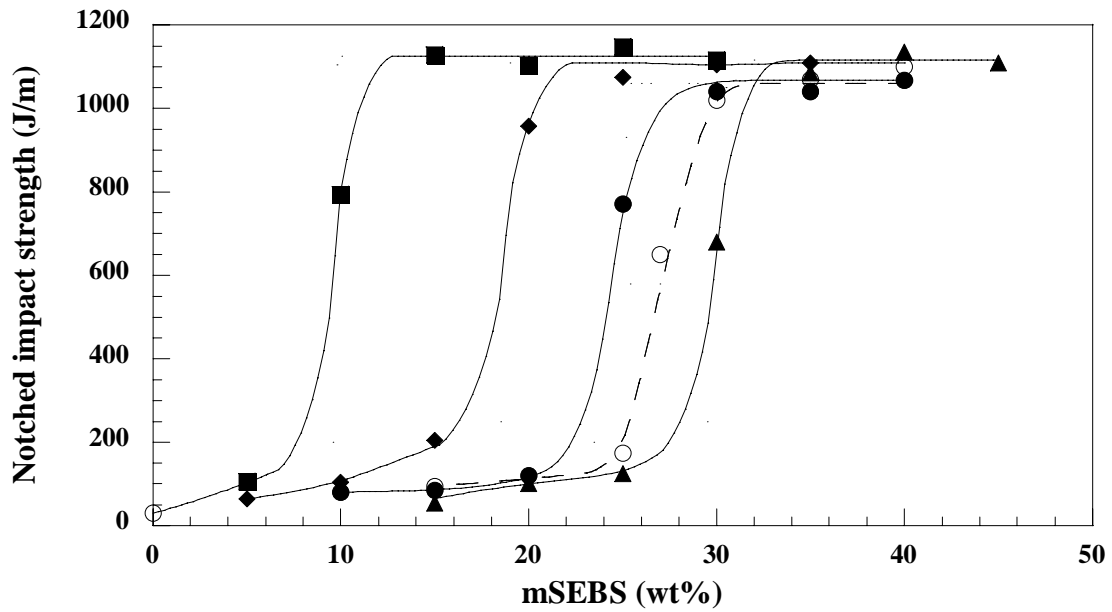
Figures:

Figure 1. Notched Izod impact strength of the reference blends (■), PN1.5% (◆), PN3.0% (●) and PN4.5% (▲). The values of the PN3% (○) obtained through the standard processing method are also shown as reference.
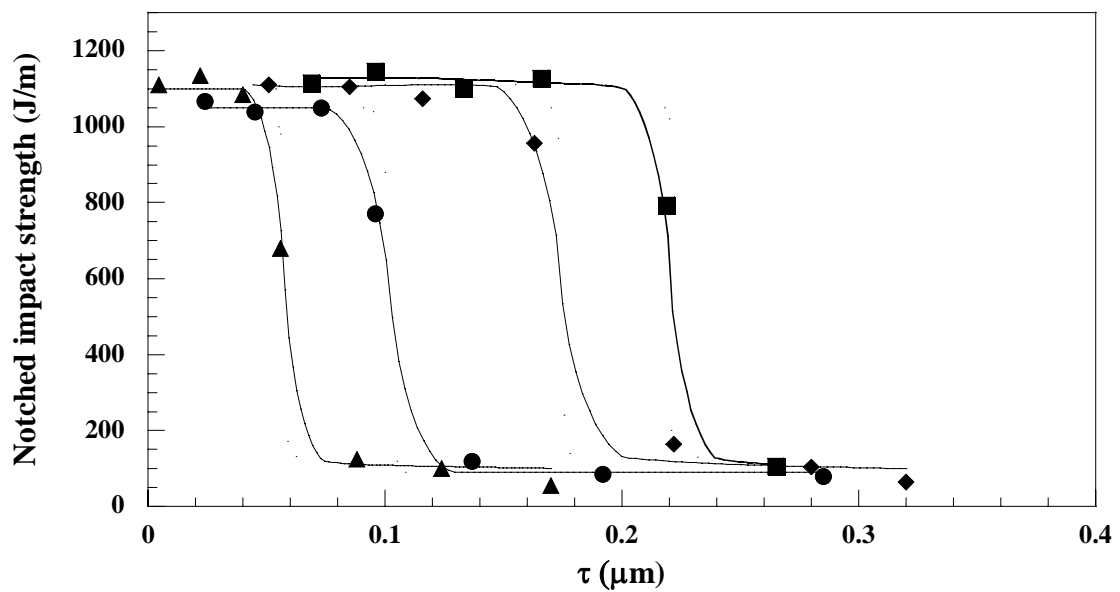

Figure 2. Corrected notched Izod impact strength of the PN´s against the interparticle distance. Reference blends (■), PN1.5% (◆), PN3.0% (●) and PN4.5% (▲).