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POLYSULFONE/ORGANOCLAY NANOCOMPOSITES: ELABORATION, STRUCTURE AND PROPERTIES.

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Introduction:

The polymer-clay nanocomposites have been actively studied during the past 20 years[1]. The most widely used reinforcement is the montmorillonite. Its high aspect ratio and its tremendous surface area (~ 760 m^2/g) coupled with the polymer matrix, facilitates stress transfer to the reinforcement phase, allowing most dramatic changes in mechanical properties[2], thermal stability[3], permeability[4], solvent resistance… and other physical properties.

In this work, we have studied nanocomposites made of a polysulfone (PSU) matrix (structure described in figure 1-a) filled with organically modified montmorillonite (o-MMT). After having optimized the elaboration process of the composites, we have studied the influence of the nanoplatelets on their mechanical, thermal, dielectrical and physical properties. In this communication, we present some results of our work.

Materials:

The structure of montmorillonite (MMT) is schematized in figure 1-b, it consists on platelets of about 9Å thick with cations in the interlayer. The organoclay presents a d-spacing (distance between two silicate layers) more important than the pure montmorillonite because of the high length of the organic part of the ions (figure 1-c). We have worked with a commercial Montmorillonite modified with alkylammonium ions. This d-spacing can be measured by X-ray diffraction (XRD)[5] as shown in figure 2.

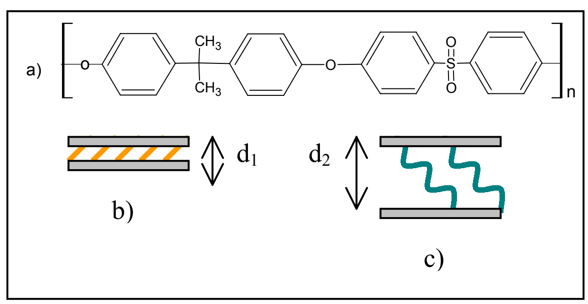

figure 1: Structure of a) PSU, b) MMt and c) o-MMT.

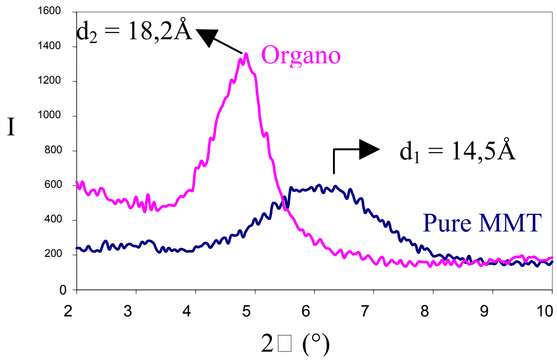

figure 2: XRD patterns for MMT and organo MMT.

Results and discussion:

✓ *Nanocomposites´ structure*

The XRD patterns of the nanocomposites show that there is a good state of exfoliation of the clay platelets for 1, 2 and 3 %wt of o-MMT (no pick appears) and that some aggregates are presents in the material for 4 and 8 %wt of o-MMT (a pick can be observed for the same valor of □ as the o-MMT). So, we have studied 2 types of nanocomposites: some exfoliated (or delaminated) and others with aggregates of MMT.

✓ *Thermal stability*

The figure 3 shows the thermogravimetric results (relative weight loss as a function of temperature), or TGA results, for the matrix PSU and for the nanocomposites. We can see that the presence of exfoliated clay platelets in the PSU considerably retards the degradation of the materials. Approximate decomposition temperature of the PSU was 462°C; then, for 1, 2 and 3 %wt it is respectively 478, 479 and 477 °C. It is observed that when the composite has an exfoliated structure, the degradation temperature augment with the amount of clay. This may be partly due to kinetic effects on the oxygen diffusion into the matrix which can be retarded by the clay platelets. On the other hand, the presence of aggregates (in the composites with 4% and 8%wt of o-MMT) implicates a reduction of the degradation temperature. We can suggest of those results that the aggregates create some point of tension in the composite, favoring the oxidation process.

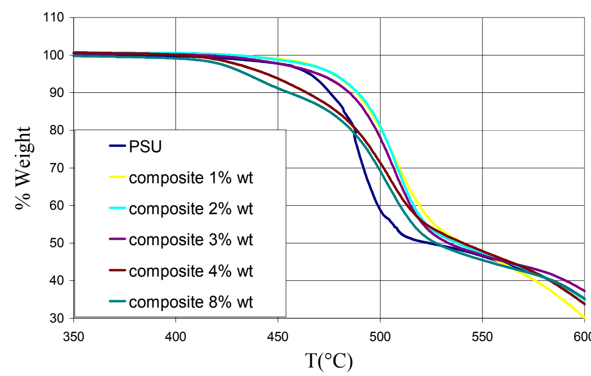

figure 3: TGA results under air flow.

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