

## Composites of PP/HDPE- CaCO<sub>3</sub>: Crystallinity and Morphology Using Virgin and Recycled HDPE .

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It is well known that the matrixes of composite materials are usually polymers. The matrix may be a mixture of polymer and the properties can be change varying the ratio of the components and the conditions used in their preparation. As the PP/HDPE is a incompatible blend such system has a microheterogeneous structure resulting from the phase separation. Introduction of fillers into the blend can cause significant changes in compatibility depending on the filler. By other hand, the used of recycle polymers can offer a way to not only diminish the costs of production but the environmental contamination [1].

In this work it was studied the thermal and morphological behavior of mixtures of of PP, HDPE. It was used PP (0,91 gr/cm<sup>3</sup>), HDPE (0,96 gr/cm<sup>3</sup>), recycled HDPE (0,96 gr/cm<sup>3</sup>) and CaCO<sub>3</sub> as filler. The formulations were made using 80% of PP and 20% of HDPE. The filler composition was 30% in weigh and its surface was coated with 1% of Lica 12 [Neopentil(dialquil)oxi-(dioctil) phosphate titanate] as coupling agent. Dispersion of filler and the adhesion between polymer and filler were studied by SEM of the fractured composite and TEM studies allowed to observe the morphological characteristic of the mixtures without filler. Crystallinity of composite materials were characterized by Differential Scanning Calorimetric (DSC) [2].

The melting and crystallinity temperatures of the mixtures of PP/recycled HDPE did not have significant variations when being compared with those of the virgin blend. The effect of the titanate coupling agents on mechanical properties of filled polyolefins have shown some improvements in impact properties of the PP/CaCO<sub>3</sub> system whereas the elongation of the composite approaches the unfilled PP homopolymer.

Figure (1a) shows poor dispersion of filler and the adhesión between PP/CaO<sub>3</sub> while Figure 1 (b) of the coated PP/HDPE(Virgin)/CaCO<sub>3</sub> indicated a better dispersion of filler as a result of the treatment with Lica 12, when recycled HDPE is used the particle size of the filler is larger and dispersion is not good. TEM studies allowed to observe a better dispersion in the system with recycled HDPE although the impact strength diminishes considerably for this material, in recycled HDPE there is not a defined interface revealing this fact a superior compatibility for PP/HDPE, figure 2.

It is interesting to point out that samples for TEM studies were prepared by Montesinos technique [3]. PP etching time was 8 hours while for the polyethylene samples etching time was of 2 hours which make difficult the simultaneous lamellar observation of PP and HDPE. Basset technique was applied to the composites without satisfactory results [4].

The coupling agent used in this work does not produce the plastifying effect in the blends, probably because its concentration was not adequate. Mechanical properties of PP and blends used in this

work indicate the possibility of using a PP blend with HDPE (80/20) loaded with  $\text{CaCO}_3$  without trying with the coupling agent, particularly when the aim is utilizing waste material, such as HDPE recycling, and using filled materials to reduce costs without deteriorate mechanical properties.

#### References

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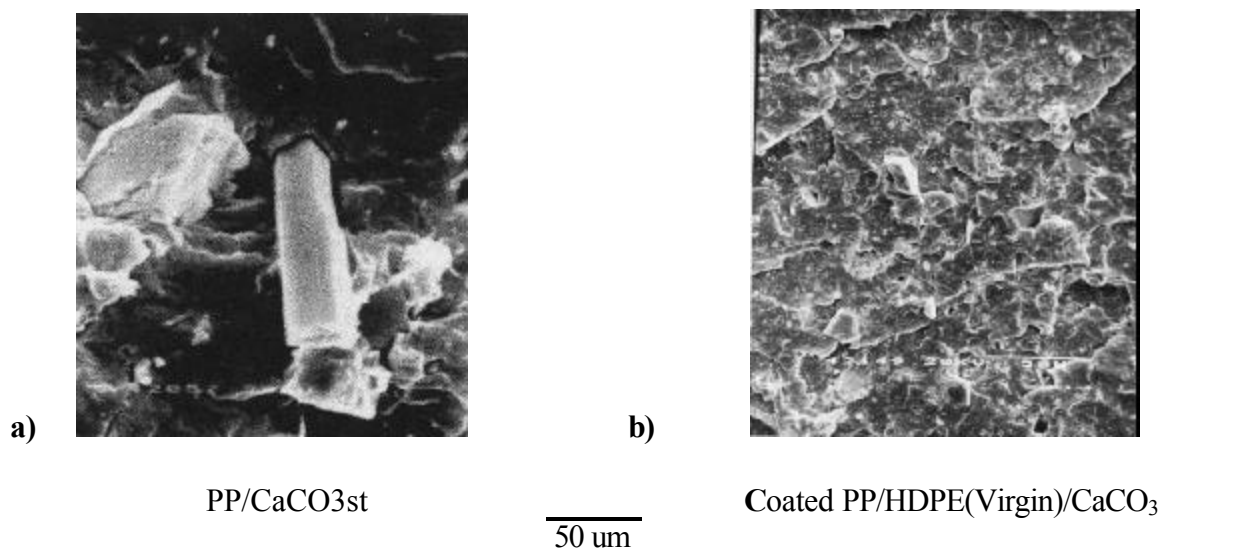


Fig. 1. SEM micrographs of fractured composite surfaces: (a) PP/Uncoated  $\text{CaCO}_3$  (b) PP/HDPE(Virgin)/coated  $\text{CaCO}_3$ .

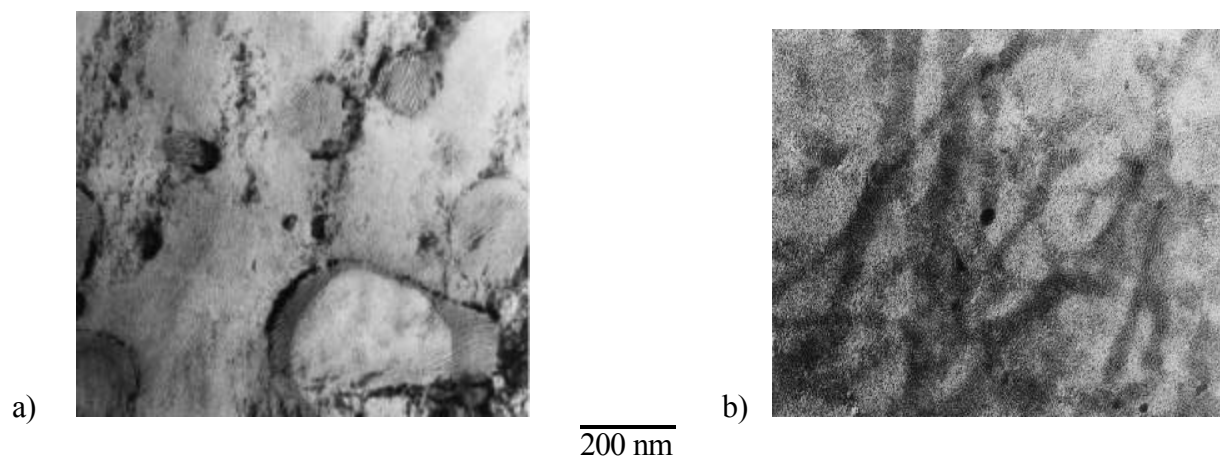


Fig. 2. TEM micrographs of : (a) PP/HDPE (virgin) (b) PP/HDPE (recycle)