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Stabilization of polypropylene with the addition of antioxidants in the polymerization reactor

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Abstract – Polypropylene is a thermoplastic polymer widely used in industry for various applications. Aiming to increase the lifetime of polypropylene antioxidants are added as stabilizers. The most used method to add these substances to the polymer involves a mixture from the molten state subsequently to production. However this method causes degradation on polymer due to the high temperatures involved. Therefore, using a Ziegler-Natta catalyst with controlled particle morphology to perform propylene polymerization and introducing antioxidant inside the polymerization reactor, spherical and stabilized polypropylene was produced.

Polypropylene was synthesized by a Ziegler-Natta catalyst system supported on $MgCl_2$ with controlled particle morphology. The preparation of this catalytic system, since the precursor of the support until the impregnation, was carried out to allow the production of polymer with spherical particles. This is possible because the synthesized polymer replicate the shape of the catalyst. Figures 1 and 2 show the images revealed by scanning electron microscopy (SEM) of the catalyt precursor.

Propylene polymerization was conducted by the obtained $MgCl_2$/DI/$TiCl_4$ catalyst system and both DE (external donor) and TEA (trietilaluminum) were introduced directly in the reaction medium. The polymerization conditions were 2 bar of monomer pressure and 70 °C.

The stabilization of polypropylene was performed by directly adding the antioxidants in the polymerization reactor at a fixed concentration. Natural antioxidants were used and their performance was compared with the synthetic commercial Irganox.

Thus, the particle morphological control combined with the in-reactor stabilization technique allowed the synthesis of stabilized polypropylene with spherical shape. With this, one extrusion step can be avoided and the cost of energy is reduces also preventing previous polymer degradation.

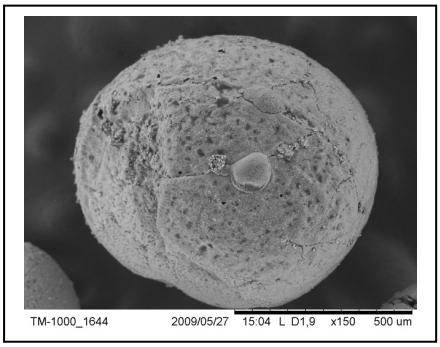

Figure 1: Image of catalytic precursor taken by SEM zoomed in x150.

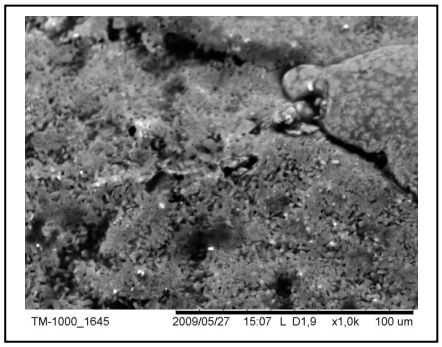

Figure 2: Image of the catalyst precursor surface taken by SEM zoomed x1000.

References

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