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Production of new Ziegler-Natta catalyst with Clay for Propylene Polymerization by chemical activation

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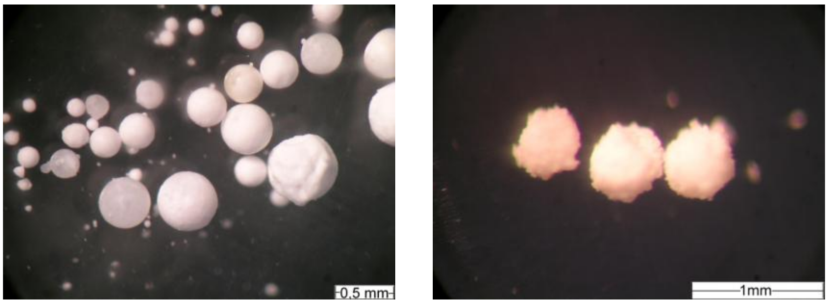
Abstract – In the present study, a methodology for the formulation of Ziegler-Natta catalysts by chemical activation process was developed. The catalysts obtained by this process have as main characteristic the morphological control necessary for the production of polypropylene in industrial scale. The catalytic systems prepared were based on $MgCl_2/TiCl_4$/ID/ED/TEA (ID and ED are internal and external electron donors). Pro-catalysts were produced based on the support $MgCl_2$ with clay and employed in polymerization of PP with the aim of producing PP/clay nanocomposites by *in situ* clay intercalation technique. Through optical microscopy analysis it was possible to observe the formation of solids with spherical shape even in the presence of clay.

Ziegler-Natta catalysts supported on $MgCl_2$ with controlled morphology are the most modern catalytic systems used industrially for the production of polypropylene in large scale. The use of adducts of $MgCl_2$ in the preparation of the catalytic support has attracted attention as a method for the development of these catalysts. These adducts can lead to supported catalysts with controlled morphology, which in turn produce polymers with controlled shape, density, and particle size distribution by the phenomenon of replication [1-2].

The present study employed the Schlenk technique. The catalysts were produced into kettle reactors under dry nitrogen pressure from anhydrous $MgCl_2$.

In figure 1, micrographs of the produced pro-catalysts are shown, both with and without clay. It can be observed that the solid obtained in the absence of clay (Figure 1a) was spherical in shape, although with large particle size distribution. As shown in Figure 1b, the solid produced with clay also shows the spherical shape and a more homogeneous size distribution when compared to the pro-catalyst without clay. Moreover, in Figure 1b, it can also be seen that the $MgCl_2$/clay support surface has much larger pores than the solid without clay. Figure 2 shows the X-ray diffractograms the employed clay and pro-catalyst with clay. In the analysis of the mineral clay a characteristic diffraction peak at $2\theta = 6.3°$ has appeared. In turn, the pro-catalyst produced in the presence of the clay showed a very broad diffraction peak in this region, and in addition it was shifted to lower angles. This indicates an increase of the clay interlayer distance, and this increase probably is due to introduction of catalytic components in the clay galleries. The results of this work are of fundamental importance since it enables the synthesis of polypropylene/clay nanocomposites with spherical particles by *in situ* polymerization technique.



(a) (b)

Figure 1: Optical microscopy of pro-catalysts: **(a)** without clay; **(b)** with clay.

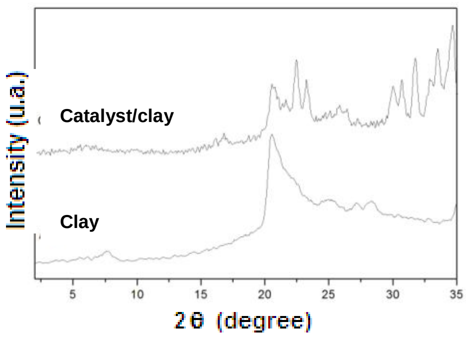


Figure 2: X-ray diffraction profiles of ZN /clay catalyst and original clay.

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