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# The Synthesis of Isotactic Polypropylene with Spherical Morphology *via* Supported Metallocene Catalyst

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**Abstract:** Polymerization of propylene was carried out under bulk process at 70°C using the supported metallocene catalyst with four kinds of $SiO_2$ as carrier with triethylaluminum used as co-catalyst. The morphology of the products was studied by SEM. It was found the property of the carriers gave great effect on the fine structure of the products as well as the apperance.

**Keywords:** Isotactic Polypropylene, spherical morphology, supported metallocene catalyst.

The morphology control of polypropylene products is one of the technological obstacles to the industrial polymerization of propylene *via* metallocene catalyst. One efficient way to solve this problem had been proposed that the metallocene catalyst should be supported on suitable carrier. Although lots of work has been reported[1-3], up to date, no breakthrough has been got yet. The studies on morphology control of supported metallocene catalysts will be of great value in either scientific or practice view. In this paper we will report the morphology control results of the iPP attained under the commercial polymerization conditions (bulk process, Tp=70°C) *via* the supported metallocene catalyst $SiO_2$/MAO/*rac*-$Me_2Si$[2-Me-4-Naph-Ind]$_2ZrCl_2$.

The method for making the supported metallocene catalyst is of high efficiency (in preparation to be published). Here we made four kinds of the supported metallocene catalyst $SiO_2$/MAO/*rac*-$Me_2Si$[2-Me-4-Naph-Ind]$_2ZrCl_2$ with different carriers: regarded as $SiO_2$2407#; $SiO_2$2408#; $SiO_2$3030#; $SiO_2$3050#. $SiO_2$2407# and $SiO_2$2408# were purchased from Grace Davison Corporation with the product number XPO-2407 and XPO-2408 respectively. While $SiO_2$3030# and $SiO_2$3050# were purchased from PQ Corporation with the product number MS-3030 and MS-3050 respectively. The polymerization was carried out in 3-litter autoclave at 70°C for 1 hour. Triethylaluminum was used as co-catalyst. The morphology of the product was detected by Hitach-500 scanning electron microscope.

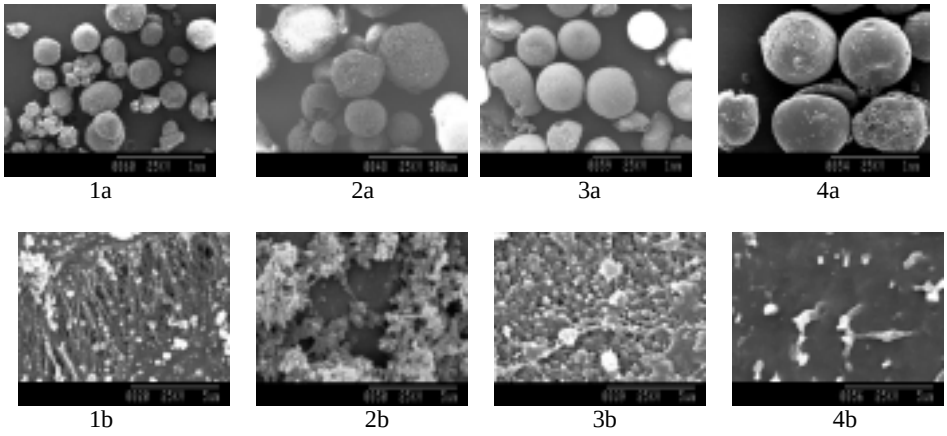
The alkylaluminum can not be used as co-catalyst for the homogeneous metallocene catalyst. But we found that for the supported metallocene catalyst

$SiO_2$/MAO/*rac*-$Me_2Si$[2-Me-4-Naph-Ind]$_2ZrCl_2$, several kinds of alkylaluminum could be used as co-catalyst to give good polymerization results. In our study, when triethylaluminum was used as co-catalyst, the morphology of the attainted polypropylene

was spherical for all samples as shown in **Figure 1** (1a~4a). But the appearance of the particles strongly depended upon the properties of the carrier $SiO_2$ that the supported catalyst used. When $SiO_2$2407# (1a) and $SiO_2$2408# (2a) were used as the carrier, the surface of the product was very rough and coarse; while $SiO_2$3030# (3a) and $SiO_2$3050# (4a) were used as carrier, the surface of the product was rather smooth and round.

The fine structure of the surface of the products (1b~4b) illustrated the difference more clearly. When $SiO_2$2407# was used as the carrier, the surface (1b) of the product was not uniform but continuous. There are lots of fibers between the bulk matrix. When $SiO_2$2408# was used as the carrier, the surface (2b) of the product was not continuous and there is large hole among the cluster-like matrix. When $SiO_2$3030# was used as carrier, the surface (3b) of the product was rough uniform continuous phase with lots of pores. When $SiO_2$3050# was used as carrier, the surface (4b) of the product was smooth uniform continuous phase. The great dissimilarity of the product morphology may be due to the difference of the carriers in their particle size, surface area, pore value, and pore size distribution. The study of mechanism of effect of the carrier's properties on the morphology is undergoing.

**Figure 1**. The SEM photography of the products from different carriers
1. $SiO_2$2407#; 2. $SiO_2$2408#; 3. $SiO_2$3030#; 4. $SiO_2$3050#

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