Chapter VI

Conclusions and Recommendations

There had been many investigations attempted to establish the most probable mechanisms and catalyst structure of polyethylene. Since Ziegler-Natta catalyst was discovered, its activity was low because of the unsupported catalyst. Then the titanium species called active centers for polymerization were supported on $MgCl_2$ as support to increase activity greatly. The supported active centers have a larger propagation constant and more stability due to the addition of third component. The addition of third component involved in the promoting the effectiveness of titanium function and it could increase the activity. It also induced many interactions between each catalyst component during the catalyst formation and cocatalyst in-situ activation. The reasonable explanations for the related phenomena depended on the knowledge and background of the researchers in chemistry and chemical engineering emphasizing in organometallic chemistry and catalyst technology.

The present investigation concentrated on ethylene polymerization by the high activity Ziegler-Natta supported catalyst, the conclusion from the experiments could be described as followings-

1.The high activity Ziegler-Natta supported catalyst used throughout the experiments was the third generation catalyst. The procedure of catalyst preparation divided in three main steps.

Step 1 Anhydrous $MgCl_2$ was modified by reaction with ethanol to produce alcohol adduct. Afterwards, triethylaluminum (TEA) reacted with alcohol adduct to remove the surface ethanol molecules. The product was reaction product.

Step 2 The reaction product interacted with $TiCl_4$ for the impregnation process of titanium active centers on the catalyst's surface. The bimetallic complex between titanium and catalyst component was then formed. The product after reaction was titanium metal catalyst component.

Step 3 The predetermined amount of titanium metal catalyst component was reacted with TEA before the polymerization started. The ratio between TEA and titanium atom on the titanium metal catalyst component was 160.

The suitable conditions that gave good catalytic activity in the ethylene polymerization on high activity Ziegler-Natta supported catalyst are at 85 ^{0}C, 1.5 hr. The titanium concentration was calculated as titanium atom supported on the catalyst surface.

The catalyst behavior was the high rate abruptly at the initial polymerization and then it decreased the polymerization sharply. The activity of the present high activity Ziegler-Natta supported catalyst was about 10 times higher than that of the unsupported catalyst. The addition of ethanol and TEA during the catalyst preparation played an important role in increasing the activity.

2. The addition of Fe_2O_3 was during the activation between TEA and titanium metal catalyst component. Fe_2O_3 did affect the catalyst behavior. The rate of polymerization reached a higher value of ethylene consumption suddenly and then it decreased sharply. The catalyst deactivation of titanium active centers occurred faster in this case than the absence of Fe_2O_3. The presence of Fe_2O_3 made the polymerization ability of titanium sites moreover induced oligomerization of ethylene by ethylene balance of ethylene conversion.

3. The polyethylene produced from the high activity Ziegler-Natta supported catalyst had better morphlogical control and smaller melt flow index than that from Fe-modified Ziegler-Natta supported catalyst. For the polyethylene from Fe-modified Ziegler-Natta supported catalyst, it found that the modification of Fe_2O_3 lowered Mv from viscometry, average molecular weight from GPC, % crystallinity from XRD measurement, and Tm from Differential Thermal Analysis. Similarly, the density of the polyethylene of both catalyst systems indicated that the products were of high density.

RECOMMENDATIONS

1. The catalyst that prepared at Catalyst Research Laboratory was the third generation catalyst for ethylene polymerization. It is highly possible to polymerize propylene as well. It has also much active areas to investigate and characterize the sterespecificity of polypropylene and various factors for catalyst behavior.

2. The addition of Fe_2O_3 cannot represent all influences of the transition metal atoms on the behavior of this polymerization catalyst. The other compounds of transition metal should use; such as halides and organic complexes.