

CHAPTER V

CONCLUSIONS & RECOMMENDATIONS

5.1 CONCLUSIONS

5.1.1 Effect of $[Al]_{d-MMAO}/[Zr]_{cat}$ ratios

The nano-alumina was used as fillers for LLDPE- Al_2O_3 nanocomposite obtained via the *in situ* polymerization with various $[Al]_{d-MMAO}/[Zr]_{cat}$ ratios. It was found that alumina particles were well distributed inside the polymer matrix at some certain amounts of them. Upon the presence of the Al_2O_3 nanofiller, the activities increased with increasing the $[Al]_{d-MMAO}/[Zr]_{cat}$ ratios. This indicated that the greater amounts of d-MMAO resulted in more active species being present during polymerization. However, activities and yields of polymerization were apparently low probably due to more steric hindrance arising from the nano-particles. 1-Hexene insertion (%) increased with the increased $[Al]_{d-MMAO}/[Zr]_{cat}$ due to less steric hindrance.

5.1.2 Effect of the amounts of the nano- Al_2O_3

The second part of this thesis investigated the influence of various amounts of filler. It was found that the activity went down with increased amounts of nano- Al_2O_3 . Decreased activity with increasing the amount of nano- Al_2O_3 was due to decreased distribution of d-MMAO. Increased amounts of the Al_2O_3 nanofiller added also apparently resulted in decreased T_m and T_c indicating less crystallinity of LLDPE. The molecular weight of polymer was found to decrease with increasing the amounts of fillers. This was due to increase rate of chain transfer reaction arising from the fillers. In addition, the broader MWD obtained by increased amounts of fillers suggested the deviation from single site nature of the catalyst.

5.1.3 Effect of filler type

With the different kinds of fillers employed, it was found that the catalytic activities during copolymerization was in the order as follows; nano- Al_2O_3 > nano- SiO_2 > nano- TiO_2 > nano- ZnO . This indicated that the nano- Al_2O_3 was good to use as fillers based on activity. The morphologies of polymer produced via various supports were investigated. It indicated that there were some changes in polymer morphologies. It can be seen that the texture of LLDPE with TiO_2 and ZnO was apparently homogeneous whereas one obtained from Al_2O_3 and SiO_2 was not. This was suggested that TiO_2 and ZnO essentially mix well with the LLDPE.

5.2 RECOMMENDATIONS

In order to overcome the poor dispersion of particle, the Al_2O_3 needs to be modified prior to use. The modification of Al_2O_3 should be further investigated in the near future. Alternatively, the ultra sound wave should be applied in order to assist the dispersion of fillers during polymerization.