CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

In this work, TiO_2 particles prepared via sol-gel process were introduced into polypropylene by the master batch manufacturing process. The resulting composites were compared with the blends prepared with commercial nanoparticles TiO_2. The effect of TiO_2 contents and the properties of TiO_2 from two sources of TiO_2 on the properties of resulting nanocomposites were studied. Results from DSC indicated that there was no change in the crystallization exotherms of TiO_2 from sol-gel process whereas composites with commercial nano-TiO_2, the added TiO_2 acted as a nucleating agent. At 5wt% and 10wt% of TiO_2 in polypropylene were able to shift the crystallization exotherms by 6°C and 8°C, respectively. TiO_2 particles prepared from sol-gel process were still in micro size whereas the commercial TiO_2 were much smaller, therefore it had more effect on the properties of polymer. The wide angle X-ray diffraction analysis showed that commercial TiO_2 can increase the degree of crystallinity of nanocomposites by increasing weight contents of commercial TiO_2 which had an correspondence to the DSC results. Thermogravimetric analysis results showed that the degradation temperature of composites prepared from both sources of TiO_2 was increased by increasing contents of nano-TiO_2 from two sources, suggesting that the addition of nano-TiO_2 can improve the thermal stability of polymer. At 1-5wt% of TiO_2 from two sources in PP, there were no adverse effects on mechanical properties of the composites, whereas at 10wt% commercial TiO_2 can increase much in Young's modulus due to higher in degree of crystallinity in this content.

The advantage of synthesis TiO_2 in sol-gel tetraol based method is the starting materials are stable in room temperature and the condition during the reaction is mild, but the obtained nanoparticles were agglomerated after calcination at high temperature. The grinding after calcination cannot control the size of particles as expected. The author would like to suggest the development of systhesis of TiO_2 to be of smaller particles in order to have larger surface area. The first is to try reducing the calcined temperature of TiO_2 to prevent the particles coming to agglomerate, but still need to make sure that it can also remove the organic substance

from the compound and after calcinations the particles should be sonicated in the solution instead of grinding. The other way is to find some coating compounds such as Hydroxypropyl cellulose and Carboxymethyl cellulose to prevent the agglomeration of TiO_2 particles.