CHAPTER V

CONCLUSIONS

5.1 Synthesis of CNPs by arc discharge in liquid nitrogen with C-C electrodes

It has been shown that arc discharge in liquid nitrogen using c-c electrodes could provide 3 types of carbon nanoparticles which are multi-walled carbon nanotubes (MW-CNTs), single-walled carbon nanohorns (CNHs) and multi-shelled carbon nanocluster (MCNPs). Arc current exhibits strong effect on formation of these synthesized products. Changing electrical current from 50 to 125A resulted in change of fraction of each product. The lower the arc current, the higher the fraction of CNHs and the total yield of the synthesized products. However, the increased arc current could lead to increased hydrodynamic diameter of the synthesized product because of the increased in fraction of MCNPs which preferably form big aggregates. This finding could help to suggest the appropriate condition for synthesizing single-walled carbon nanohorns (CNHs) which are supposed to exhibit high specific suface area due to its irregular morphology.

5.2 Synthesis of CNPs by arc discharge in liquid nitrogen with Fe-C electrodes

With the hint of previous investigation, it was found that cathode is not consumed by arc discharge. Therefore, Fe electrode was employed as the cathode with an aim of its function as the catalyst for synthesis of CNPs. As expected, due to arc discharge temperature, some part of iron electrode could be vaporized and engage in formation of another type of carbon nanoparticles which is Fe encapsulated carbon nanoparticles. From microscopic analysis, could be clearly seen that the synthesized products consist of iron nanoparticles clusters, CNCs and MCNPs. Using different sizes of electrodes could also provide significant difference of the synthesized products. With a larger carbon anode which could accommodate higher current, the most appropriate condition for synthesizing CNCs is to employ arc discharge with the electrical current of 175A. Microscopic analysis reveals that CNCs with very high purity could be obtained when the employed arc current is equal to or larger than 175A. Similar to arc discharge using C-C electrodes, the increased arc current for arc discharge using Fe-C electrodes resulted in the decreasing of production yield, but the increasing in hydrodynamic diameter of the synthesized product.

5.3 The effect of concentration of CNPs on nanoparticles properties

The direct mixing-processing technique used in this study is suitable for fabrication of the i-PP/CNPs nanocomposites. The differential scanning calorimetry (DSC) results show that the presence of carbon nanostructures results in a shift of the peak of melting temperatures towards the lower values with a further increase in carbon nanostructures concentrations. The i-PP nanocomposite with 5wt% of CNPs shows the similar crystallinity as seen for pure i-PP. However, nanocomposites with 10 and 15wt% of CNPs show the lower crystallization than that of the pure i-PP.

During crystallization, the increasing CNPs content compounded with i-PP exhibits a decrease in capability of nucleation.

5.4 Recommendation for future work

In this work, it was illustrated that synthesis of carbon nanoparticles by arc discharge and their applications as filler for polymer nanocomposite could be achieved. In addition, the syntheses of high purity carbon nanocapsules were obtained. These synthesized CNPs could be employed in some specific applications, such as gas storage or gas sensors. Thus, we will study their capability of gas storage and release and then, comparison with those of CNPs obtained from other sources. In addition, these CNPs should be further investigated as filler for making other polymer nanocomposites such as polyethylene (PE), polystyrene (PS) and etc.