Chapter 6

Conclusion

The following major conclusions are drawn from this study:

1. The processing stages in this study cause a good dispersion and satisfactory ratio of $CaCO_3$ in the composites.

2. An increase in $CaCO_3$ volume fraction results in :
   - The increasing of Young's modulus
   - The reduction of tensile strength
   - The reduction of ductility

3. Various models proposed for two phase materials have been examined to fit the measured mechanical properties of $CaCO_3$ filled HDPE composites. For modulus, Kerner's equation was found to be able to predict the experimental values whereas the tensile strength was not achieved by any equation.

4. The type of testing influences the observed mechanical properties of the composites. The composites behave as a ductile material in compressive test while they fail in both ductile and brittle manner in tension, depending on the filler content.

5. For annealing treatment, the crystallinity of polyethylene matrix increases with annealing temperature for up to 135 °C. These result in the increasing of Young's modulus and tensile strength of the composites with annealing temperature for the same volume fraction of $CaCO_3$. However, the strain at break of the composites does not show the annealing temperature dependence.

Future work

The research continued several implications for future study of

1. Comparing the mechanical properties of calcium carbonate filled high density polyethylene composites obtained from compression molding to that from injection moulding or other methods.

2. Producing tougher and stronger composites by the methods such as using coupling agents to improve the adhesion of the filler and polymer matrix or direct polymerization of polyethylene on the filler surface.

3. Using different filler particle size to examine the effect of filler size on the mechanical properties of the composites.

4. For annealing treatment, the thickening of lamellae should be characterised quantitatively to understand the process in greater details.

5. The debonding process should be further investigated in details to understand the process better thus can aid the improving the inventing better materials.