CHAPTER VI

CONCLUSIONS

The most appropriate blend composition of PC/ABS, processing conditions and fiber and matrix content of Kevlar-reinforced PC/ABS composite were determined to achieve the most effective ballistic property of the composite. In order to investigate this property, mechanical properties, thermal properties and ballistic property of polymer matrices and ballistic composites were measured and used for the investigation.

From the matrix investigation, the flexural modus of the PC/ABS blends at various PC contents exhibited a positive deviation from the rule of mixing. The highest modulus value of 2.66 GPa was observed in the blend system containing approximately 60 wt% of ABS and 40 wt% of PC. Furthermore, the flexural and tensile strength of PC/ABS blend exhibited two distinct regions which different in deviation from the rule of mixing. The existence of the two distinct regions corresponds with the morphology of the blend as observed in SEM micrographs of the blend.

PC/ABS blend exhibited two T_g's of the PC-rich and ABS-rich phases. The T_g's were found to shift to high value with an increasing amount of PC in the blends. The evidence of the shifts in T_g's confirm partial miscibility of the two polymers. From TGA thermograms, the degradation temperature of PC/ABS blends increased from 391°C of pure ABS to 490°C of pure PC with increasing PC content in the blend. Additionally, degradation temperature of the blend also exhibits the similar trend with the glass transition temperature of the blend.

In composite fabrication, melt viscosity of each matrix had been fixed at the same value of 480 Pa.s by varying the processing temperature and the optimal processing pressure and time are 25 MPa and 30 minutes respectively.

From the low level ballistic impact test of 20-ply Kevlar-reinforced PC/ABS composites using 9 mm hand gun with a standard gain of a round lead projectile with lead outer coating, it reveals that the composite with 40/60 mass ratio of PC/ABS matrix exhibits the highest ballistic efficiency in comparison with the other composites with different mass ratio of PC/ABS matrix. The flexural modulus of the highest ballistic resistant composite was between 10-13 GPa and the areal density of the composite is 0.23 g/cm^2 in 10 piles/panel composite.

SEM was used to indicate the appropriate adhesion between Kevlar fiber and 40/60 PC/ABS matrix. The composite displayed considerable amount of matrix failure and interfacial failure in comparison with the composite with pure PC and pure ABS as matrix.

The results obtained from NIJ level III-A ballistic impact test can conclude that the optimal number of piles of the composite to protect ballistic impact at this level is 50 piles. Additionally, in order to observe the effect of composite panel arrangement to the ballistic efficiency, it reveals that at least 30 piles of the composite should be placed on the front face to deform the bullet and yield the best ballistic efficiency moreover the arrangement of the composite panel does not effect to the ballistic resistant efficiency of the composites with sufficient front faces integrity.