# CHAPTER XI
# PC/PLA BLENDS COMPARED TO COMMERCIAL GRADES

## 11.1 Abstract

PC/PLA blends system was successfully prepared and impact strength and HDT of this material with the compatibilizer were adjusted for automotive and mobile device applications. It can be found that adding PS-g-GMA provided the excellent mechanical properties especially impact strength and HDT to PC/PLA blend system. These properties as well as estimate cost were similar to PC product, suggesting that PC/PLA blend system can be replaced commercially available product.

## 11.2 Introduction

All composition of PC/PLA blends without the compatibilizers are generally immiscible, which cause low mechanical properties especially impact strength. To improve the mechanical properties of the PC/PLA blend, additional compatibilizers are used to improve mechanical properties of the blend. Poly(styrene-co-acrylonitrile)-g-maleic anhydride (SAN-g-MAH), Poly(ethylene-co-octene) rubber-maleic anhydride (EOR-MAH) and poly(ethylene-co-glycidyl methacrylate) (EGMA) (Lee, J. K., 2011) were the examples of additional compatibilizers in PC/PLA blend. Khowanit, M. *et al.*, (2012) found that ethylene methyl acrylate copolymers (EMA) can dramatically improve the impact strength of PLA/PC blends but HDT were not significant improved compared to PC70.

PC70 has the highest mechanical properties such as tensile strength and flexural strength in the all ratio of the PC/PLA blends. Furthermore, the composition of the PC/PLA blend from the commercial grade is approximately PC70. Therefore, PC70 is the optimum composition of the PC/PLA blends to do further experiment.

The properties of PC/PLA/compatibilizers were investigated and screened by mechanical properties to select the optimum formulas to examine HDT and weather ability. Three optimum formulas of PC/PLA blends are PC70E1, PC70L0.1 and

PC70G0.5. The best formula of PC/PLA blends was selected to compare the mechanical properties to the benchmark.

PC70G0.5 is the suitable formula for automotive and mobile device applications due to high impact strength and HDT closed to neat PC.

In this chapter, Benmarking between PC70G0.5 and the commercially available product have investigated.

## 11.3 Results and Discussion

Table 11.1 illustrates the properties of PC70G0.5, PC/PLA/EMA blends as the previous work and commercially available PC/PLA blend system. The datasheet of previous and current work of PTT research and commercial product from RTP was provided for comparison. PC70G0.5 provided excellent mechanical properties especially impact strength as same as commercially available product. Moreover, HDT of PC70G0.5 was closed to neat PC and higher than those of the previous work and commercially available product suggesting this material is suitable for automotive and mobile device applications.

Table 11.1 The properties of PC70G0.5 compared to the previous work and commercial grade

| PROPERTIES | PC | RTP (2099X) 121235 D | PC/PLA(70/30) EMA 10 PHR | PC/PLA(70/30) PS-G-GMA 0.5 PHR | PLA | UNIT |
|---|---|---|---|---|---|---|
| Tensile Strength | 62 | 48.3 | 51.1 | 66.1 | 61.4 | MPa |
| Young's Modulus | 2238 | 2070 | 2299 | 2842 | 4636 | MPa |
| Flexural Strength | 92.9 | 82.7 | 68.7 | 103.7 | 91.2 | MPa |
| Flexural Modulus | 2455 | 2410 | 2310 | 2879 | 2824 | MPa |
| Notched Izod Impact strength | 80 | 85 | 89 | 88 | 7.2 | $kJ/m^2$ |
| Heat distortion temperature (HDT) | 125 | 54.4 | < 80 | 112.9 | < 60 | °C |

## 11.4 Conclusions

PC/PLA blend system was successfully prepared for commercially available propose. Adding 0.5 phr PS-g-GMA offered significant enhancement on the impact strength and HDT of PC/PLA blend. PC70G0.5 exhibited the similar properties as PC. Therefore, PC70G0.5 is a potential formula to scale-up to commercial product for automotive and mobile device applications.

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