CHAPTER IV
RESULT AND DISCUSSION

In these sections, mechanical properties, thermal properties and morphology of HDPE/PBT (without compatibilizer), PBT/HDPE-*g*-MAH and HDPE/PBT (with compatibilizer) blends have been investigated.

4.1 Mechanical properties

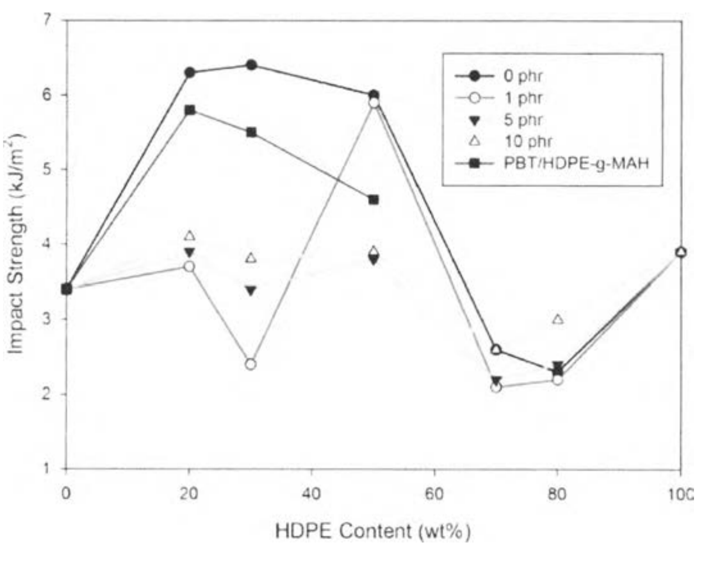

Figure 4.1 Impact strength of HDPE/PBT, PBT/HDPE-*g*-MAH and HDPE/PBT with compatibilizer.

From figure 4.1 HDPE/PBT shows the highest impact strength compared with PBT/HDPE-*g*-MAH and HDPE/PBT with compatibilizer. PBT/HDPE-*g*-MAH has higher impact strength than that of HDPE/PBT with compatibilizer at low content of HDPE-*g*-MAH. In contrast, HDPE/PBT with compatibilizer has higher impact strength than that of PBT/HDPE-*g*-MAH at HDPE content 50%.

Impact strength of pure PBT is lower than binary blend of HDPE/PBT, while impact strength of HDPE/PBT decreases with increasing HDPE content. Impact strength of PBT/HDPE-*g*-MAH is higher than pure PBT but less than binary blend of HDPE/PBT. When HDPE-*g*-MAH content increases, impact strength of PBT/HDPE-*g*-MAH decreases .

Impact strength of tertiary blend, HDPE/PBT with compatibilizer increases with increasing HDPE content until reach 50% HDPE content the impact strength start to decrease.

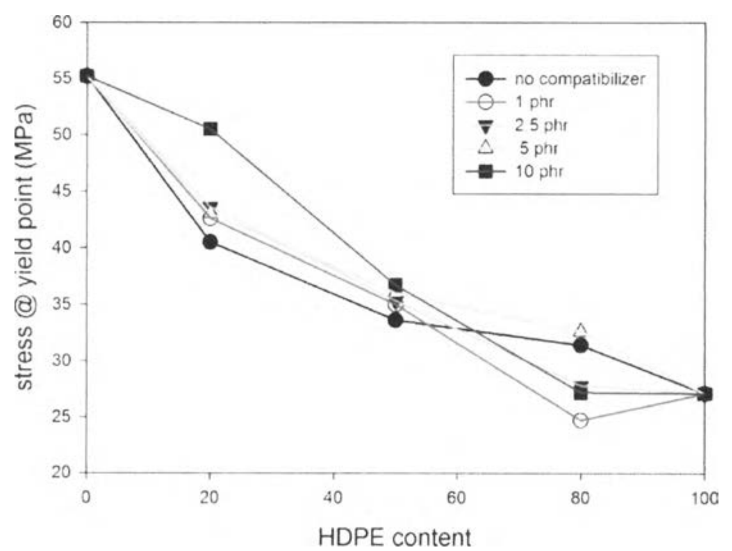

Figure 4.2 Stress at yield point of HDPE/PBT and HDPE/PBT with compatibilizer.

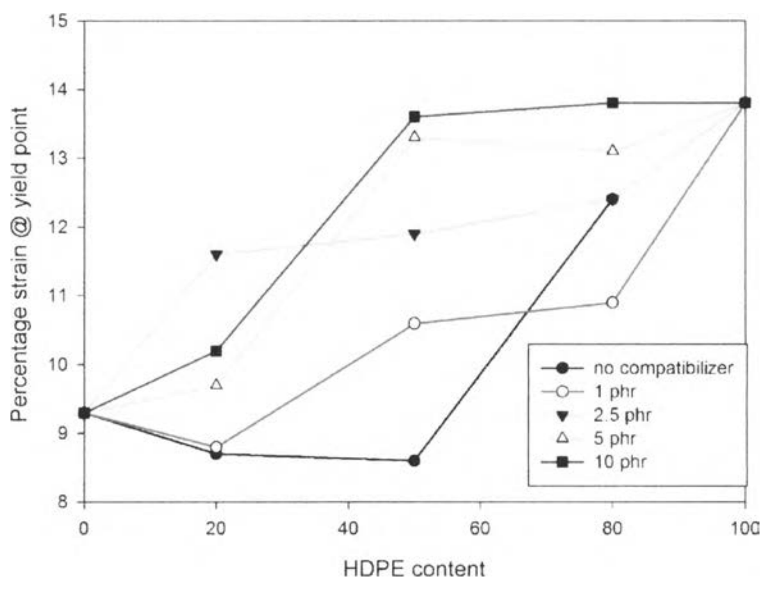

Figure 4.3 Percentage strain at yield point of HDPE/PBT with compatibilizer.

From figure 4.2 - 4.3 stress and percentage strain at yield point of binary blend is less than tertiary blend. Stress at yield point was found to reduce, when HDPE content increases. In the other hand, Percentage strain at yield point increases with increasing HDPE content.

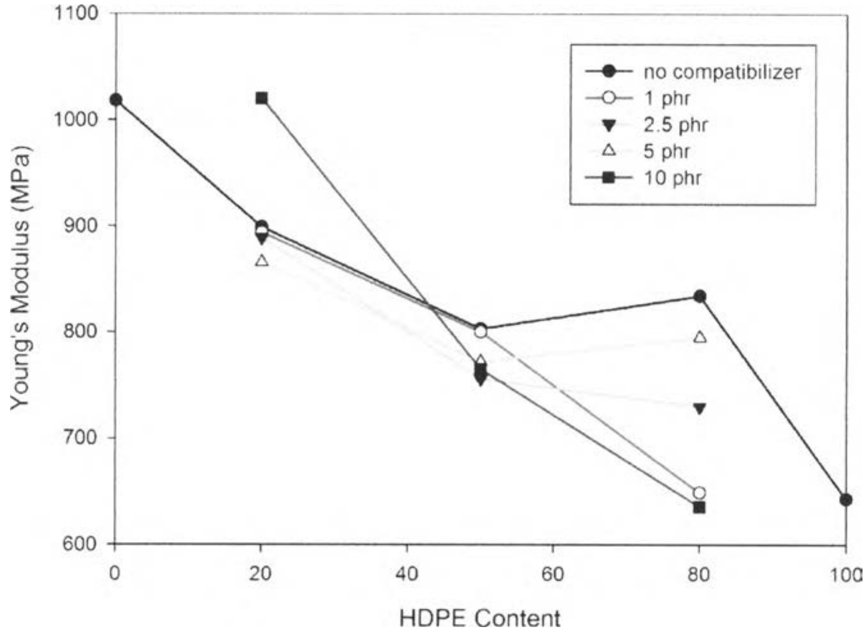

Figure 4.4 Young's modulus of HDPE/PBT and HDPE/PBT with compatibilizer.

Young's modulus of HDPE/PBT is higher than HDPE/PBT with compatibilizer except at low content of HDPE of 10 HDPE/PBT with 10 phr compatibilizer. Trend of Young's modulus seem to be decrease with increasing HDPE content.

4.2 Morphology

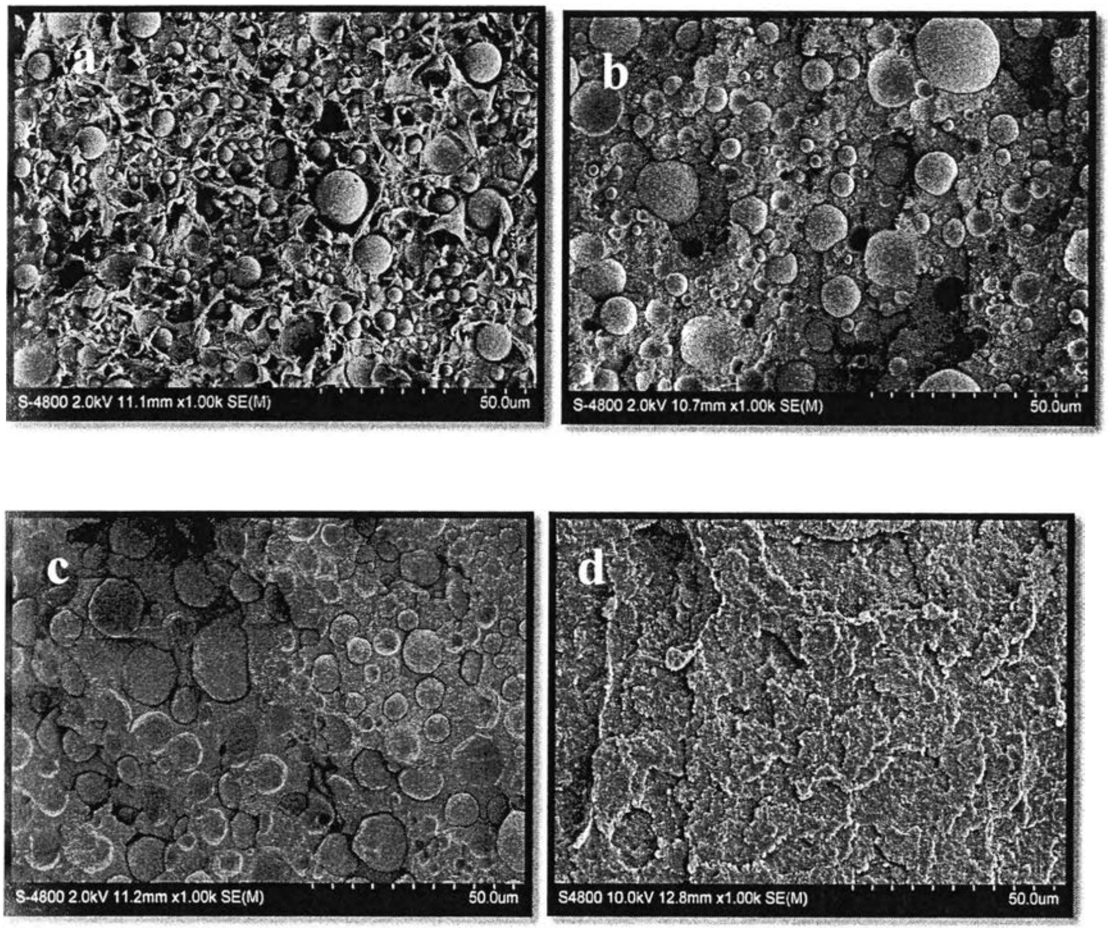

Figure 4.5 Phase morphology of HDPE/PBT (a-b) and PBT/HDPE-*g*-MAH (c-d).

Figure 4.5 demonstrated that there was a different in phase morphology of HDPE/PBT. In picture a (HDPE/PBT 80/20) showed elongated HDPE and a large space between major and minor phase. On the contrary, picture b (HDPE/PBT 70/30) did not reveal these characteristics. In figure 4.5c, HDPE/PBT 30/70 has big droplets of HDPE. In figure 4.5d, the droplets of HDPE in PBT/HDPE-*g*-MAH are smaller than that of HDPE/PBT 30/70. Space between major and minor phase of PBT/HDPE-*g*-MAH are not clear to observe.

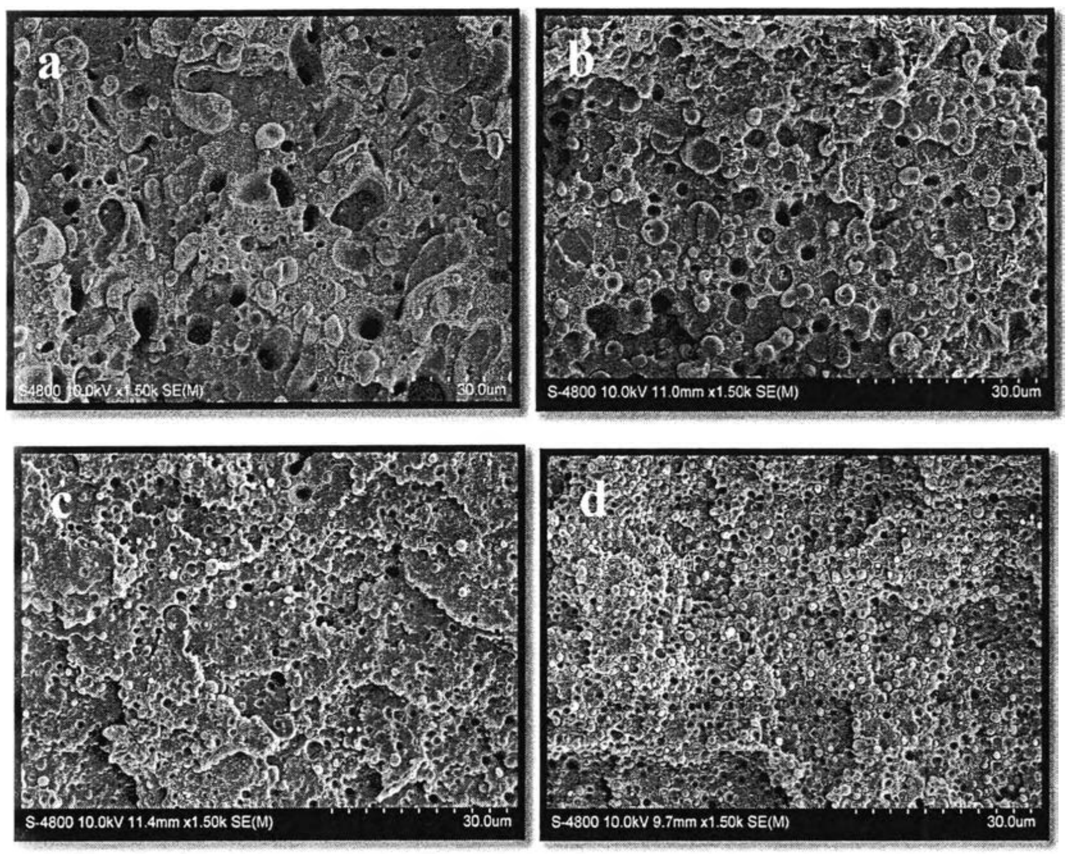

Figure 4.6 Phase morphology of HDPE/PBT 50/50 a) 0 phr b) 1 phr c) 2.5 phr d) 5 phr.

Adding HDPE-*g*-MAH as a compatibilizer has an effect on phase morphology. The more compatibilizer, the less droplets of PBT occurring.

4.3 Thermal properties of HDPE/PBT/Compatibilizer

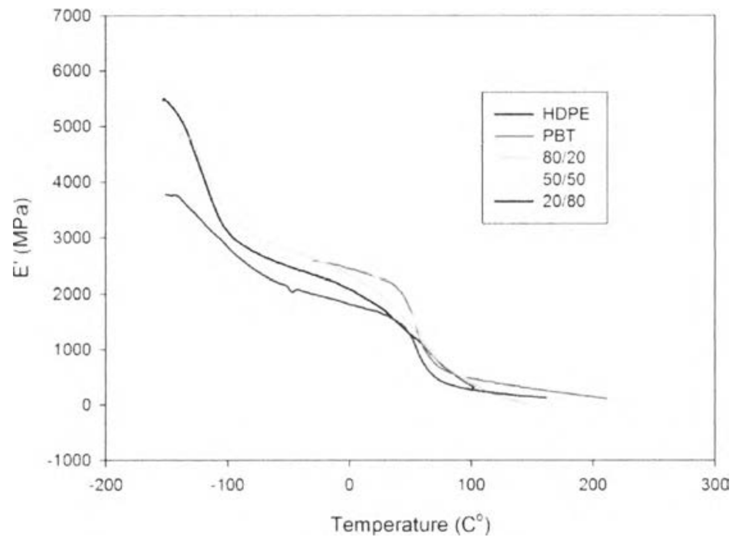

Figure 4.7 DMA spectra of HDPE/PBT 80/20, HDPE/PBT 30/70 and HDPE/PBT 20/80 blend with no compatibilizer.

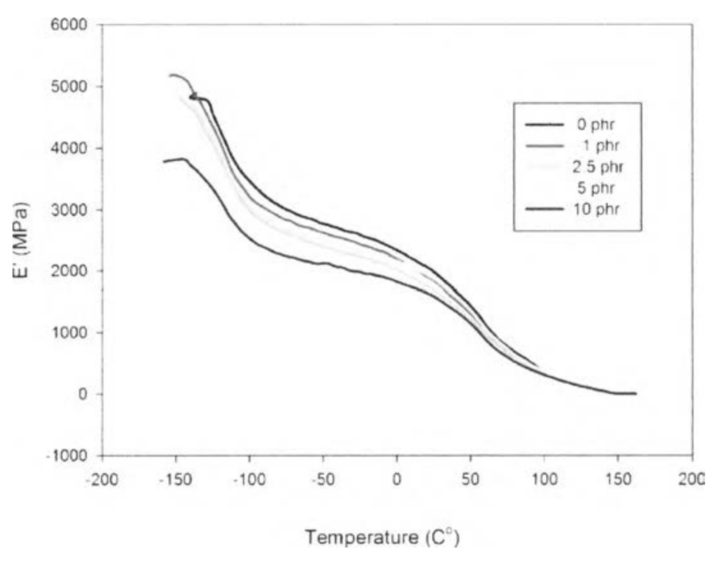

Figure 4.8 DMA spectra of HDPE/PBT 80/20 blend with compatibilizer 0, 1, 2.5, 5 and 10 phr.

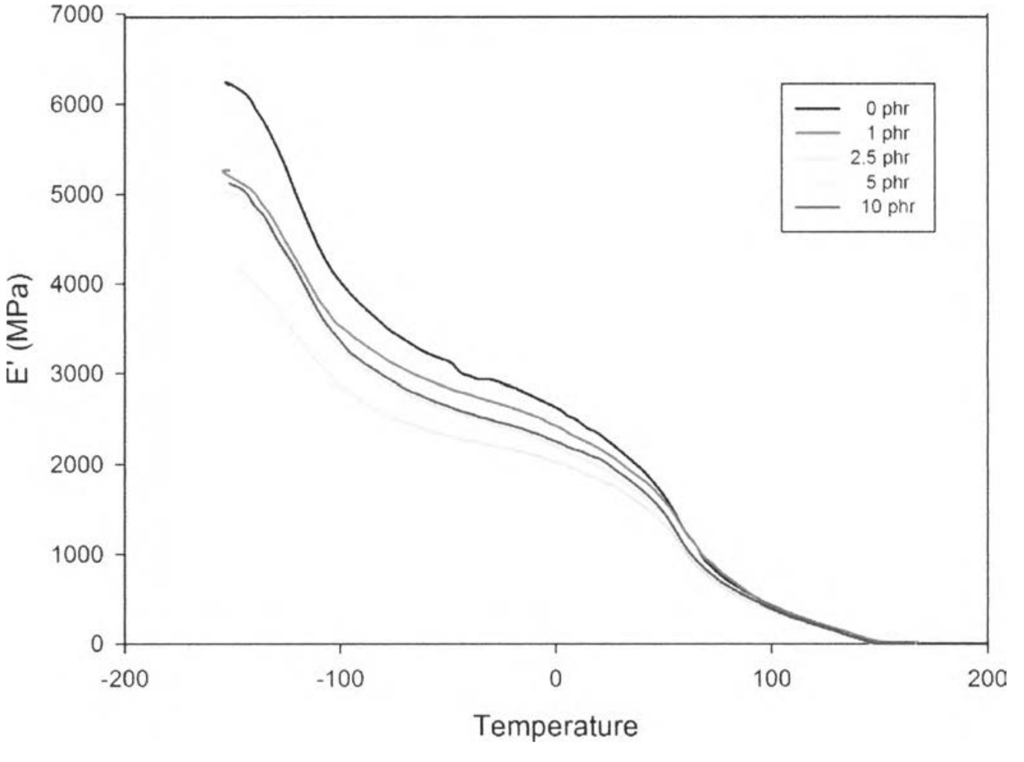

Figure 4.9 Loss modulus of 50/50 HDPE with compatibilizer.

In figure 4.7, DMA spectra of blend shows that ratio of HDPE has an effect on loss modulus. From figure 4.8-4.9, loss modulus of HDPE/PBT reduces with increasing amount of compatibilizer.

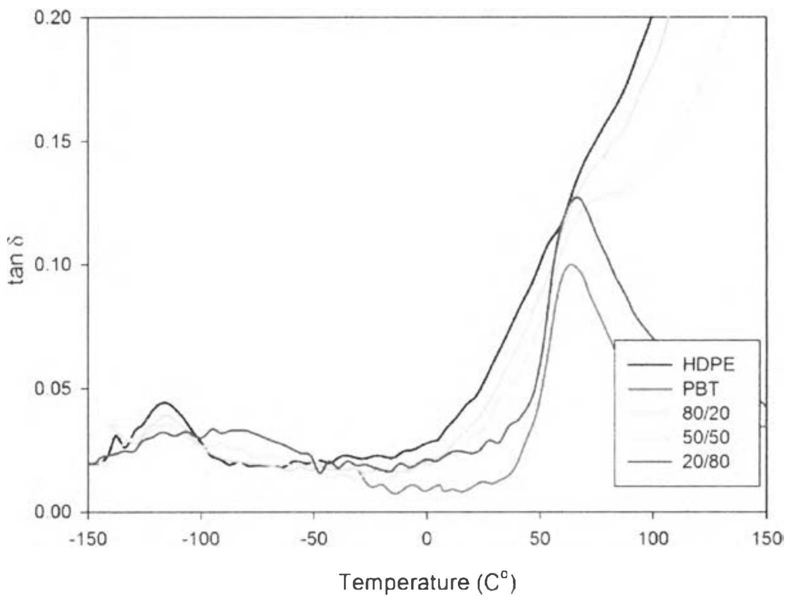

Figure 4.10 Tan δ of binary blend (HDPE/PBT) with different ratio.

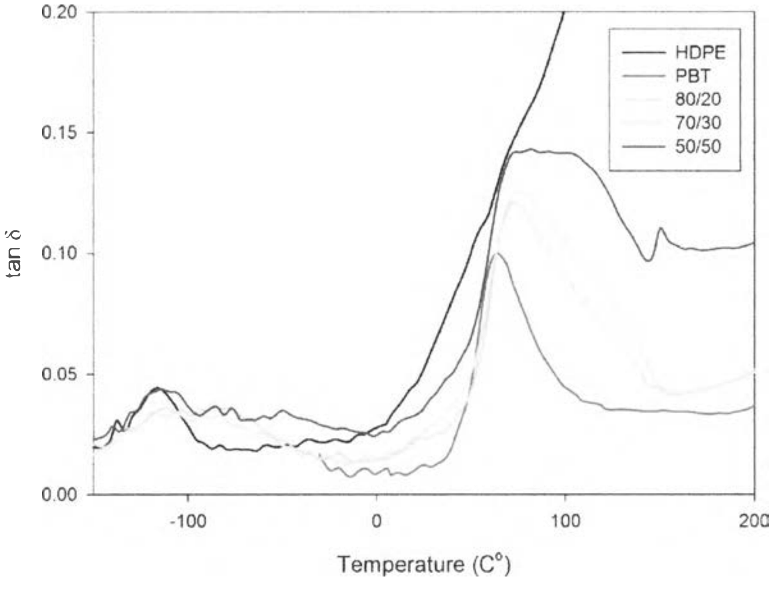

Figure 4.11 Tan δ of binary blend (PBT/HDPE-g-MAH) with different ratio.

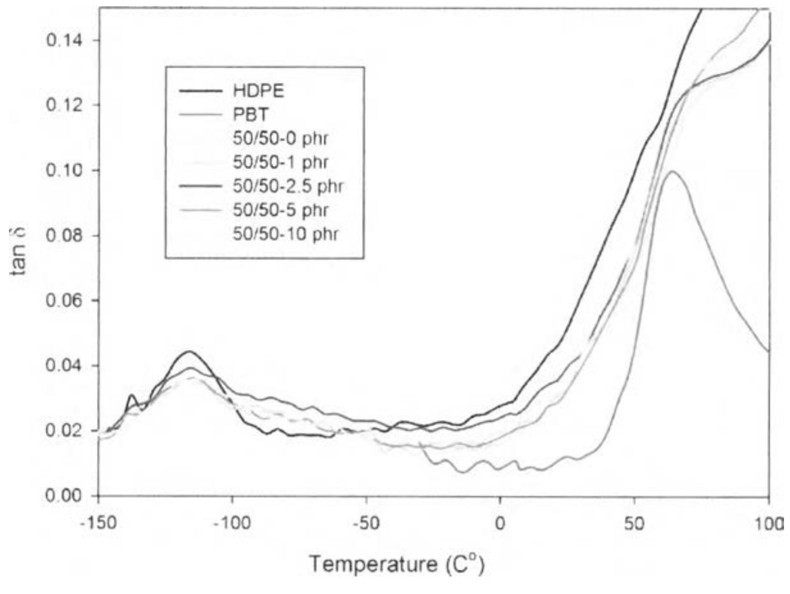

Figure 4.12 Tanδ of tertiary blend (HDPE/PBT with different content of compatibilizer).

In figure 4.10-4.12 illustrated Tanδ binary blnd and tertiary blend respectively. The result indicated that there is no shift of temperature in HDPE/PBT blend which is showed in figure 4.10. However in figure 4.11, there is some change of temperature in binary blnd (PBT/HDPE-g-MAH) which indicated that compatible blend occurred. In figure 4.12 showed tertiary blend, adding HDPE-g-MAH does not improve compatibility of tertiary blend.

Table 4.1 Degree of crystallinity, crystallization temperature and melting temperature of HDPE/PBT and PBT/HDPE-*g*-MAH blend

System	X_c		T_c (C°)		Tm(C°)	
HDPE/PBT	HDPE	PBT	HDPE	PBT	HDPE	PBT
80/20	48.2	5.5	119.84	-	133.07	-
						229.94
70/30	12.0	21.0	118.59	194.21	131.71	217.94
						224.08
50/50	30.1	13.0	119.65	193.09	132.68	213.9
						223.9
30/70	18.3	18.1	119.24	193.37	132	217.75
						223.88
20/80	12.0	20.7	118.23	192.76	131.87	218.15
						224.62
PBT/HDPE-*g*-MAH						
80/20	9.7	20.7	109.53	192.74	128.31	213.92
						224.18
70/30	15.8	17.7	118.15	191.81	130.25	213.51
						223.76
50/50	25.6	13.5	118.87	191.36	132.32	-
						223.52

Table 4.1 shows that T_c and T_m of PBT/HDPE-*g*-MAH blend shift from T_c and T_m of HDPE/ PBT. X_c of PBT/HDPE-*g*-MAH blend are less than that of HDPE/ PBT.

Table 4.2 Degree of crystallinity, crystallization temperature and melting temperature of HDPE/PBT 50/50 with compatibilizer blend

System	X_c		T_c (C^o)		T_m(C^o)	
HDPE/PBT	HDPE	PBT	HDPE	PBT	HDPE	PBT
50/50						
0 phr	30.1	13.0	119.65	193.09	132.68	213.90
						223.90
1 phr	31.3	12.8	120.60	192.06	131.84	217.55
						222.62
2.5 phr	26.2	12.0	120.07	190.89	136.07	215.91
						225.42
5 phr	32.3	12.6	120.76	191.91	132.59	-
						223.03
10 phr	33.5	13.5	120.72	-	131.13	-
						228.18

Table 4.2 illustrates that HDPE-*g*-MAH has an impact on on X_c and T_c of HDPE and PBT. In contrast, HDPE-*g*-MAH does not affect T_m of HDPE/PBT.