

## CHAPTER V

### CONCLUSIONS

Our results demonstrate that the addition of P(S-b-I-b-S) triblock copolymer to the interface between two immiscible PS/PI-100 blends and PPO/PI-100 blends can greatly modify the thermal, mechanical, viscoelastic properties and fracture surface morphology.

For the thermal properties of PS/PI-100/SIS blends, there is no change in the alpha transition temperature of hard phase with the addition of 1-5 wt % of triblock copolymer. A splitting in the alpha transition of the hard phase can be found when the triblock copolymer concentration is above 7 wt %. This is believed to correspond to the onset of micelle formation, so that we observed two  $T_{\alpha}$ 's. The upper  $T_{\alpha}$  is a amorphous PS homopolymer and the lower is  $T_{\alpha}$  of PS micelles in the PI matrix. In the case of PPO/PI-100/SIS blends, we observed changes in the alpha transition temperature of the hard phase with the addition of 1-20 wt % of triblock copolymer. At 3 wt % which is believed to correspond to the onset of micelle formation, there exist two  $T_{\alpha}$ 's. The upper appears to be the  $T_{\alpha}$  of amorphous PPO homopolymer and the lower is probably  $T_{\alpha}$  of PPO homopolymer in the vicinity of PS segment of the PI micelles and PS segment at the interface. The appearance of two  $T_{\alpha}$  values is believed to define the limit of conventional compatibilization by the block copolymer, i.e. emulsification and interfacial reinforcement.

For the mechanical properties measurements in the glassy/rubbery state of PS/PI-100 blends and PPO/PI-100 blends, the results reveal that the micelle formation has only a minor influence on the values of  $G$  and  $\tau_y$  which continue to increase up to 20 wt % of triblock copolymer. This appears to be due to

development of a fibrillar network morphology in both PS/PI-100 and PPO/PI-100 systems.

From the stress relaxation,  $G_g$  increases with the addition of triblock copolymer in both PS/PI-100 blends and PPO/PI-100 blends in parallel to the increases in  $G$  and  $\tau_y$ . This is additional evidence for effective compatibilization. From the relaxation spectrum with exponential decay, steeper rates can be seen in PPO/PI blends relative to slower power-law relaxation in the PS/PI-100 blends. In the PPO/PI-100 blends, addition of copolymer increases stress relaxation rates. This result suggests that the specific interaction between PPO and PS segment can enhance the strength of the PI matrix, so the slope of relaxation spectrum becomes steeper.

The fracture surface morphology of the ternary blends, as seen by the scanning electron microscopy (SEM) shows that the PS/PI-100 blends morphology changes due to the addition of a triblock copolymer. A decrease in size of PS dispersed phase is due to the emulsification by the triblock copolymer. A smaller decrease in size was found for the PPO domains on addition of triblock copolymer in PPO/PI-100 blends. At 20 wt % of triblock copolymer, fracture surfaces reveal that the major PI phase becomes fibrillar for both PS/PI-100 blends and PPO/PI-100 blends. Both results seem to be consistent with the thermal and mechanical properties data.