

CHAPTER III

EXPERIMENTAL

3.1 Materials

All the materials used for this work were commercial products and they were used as received without any further treatment. Poly(butylene terephthalate), PBT, natural grade Ultredur B4520 was obtained from BASF The Chemical Company. A compatibilizer based on High density Polyethylene (HDPE) graft with Maleic anhydride (MAH), commercially known as Fusabond, grade E100, was obtained from DuPont. High density Polyethylene (HDPE), grade H6007JU, with melt index of 7.5 g/10 min (ASTM D1238) was kindly supplied by Siam Cement Group Chemicals. Prior to melt blending the materials were dried for 24 h at 60°C in an oven.

3.2 Equipment

3.2.1 Twin Screw Extruder

All the materials in this research were blended in the Collin D8017 T-20 twin screw extruder, screw speed was 40 rpm, the blends were extruded throughout the die as the extrudates. The blend was cooling in water bath and dried at room temperature.

3.2.2 Compression Molding

Blend pellets were placed in a DMA frame mold with specific thickness and the mold preheated at 240°C for 5 minutes in the press without applied pressure by Wabash V 50 H 50 ton compression press machine. The mold was continue to compressed under pressure force of 10 tons for 5 minutes and then the mold was cooled to 100°C under same pressure as compression step.

3.2.3 Injection

Injection machine was 40 tons BatterField Brand. Diameter of screw was 22mm, screw speed at 265 rpm and the cooling time was 30 sec.

3.2.4 Tensile Properties Testing

Tensile properties were getting from an Instron Universal testing machine by following ASTM D638-91. Results were averaged from testing five times per sample specimen per each batch of blended material.

3.2.5 Impact Property Testing

Izod impact strength was measured using a Zwick Impact tester according to ASTM D256-92 test procedure. The result was collected from the average of five specimens per each batch of blended material.

3.2.6 Dynamic Mechanical Thermal Analyzer (DMA)

DMA instrument using in this research was operated in tensile mode and static force as well as dynamic force. The measurements was carried out at the temperature from -150°C to 160°C for HDPE/PBT blend, which high content of HDPE and were carried out at the temperature from -150°C to 210°C , which high content of PBT.

3.2.7 Differential Scanning Calorimeter (DSC)

The measurements were carried out under nitrogen condition, using 7-10 mg of blended sample. Perkin-Elmer DSC7 instrument used for testing was previously calibrated with indium. The analysis was carried out in 3 steps as heat-cool-heat: (i) samples were heated from 30 to 200°C at heating rate of $80^{\circ}\text{C}/\text{min}$ and held at 250°C for 5 minutes. (ii) samples were then cooled from 200°C to 30°C at cooling rate of $10^{\circ}\text{C}/\text{min}$. (iii) after that, samples were immediately heated from 30°C to 200°C at heating rate of $10^{\circ}\text{C}/\text{min}$.

3.2.8 Scanning Electron Microscope (SEM)

The scanning electron microscopy was performed with a Hitachi S-4800 field emission scanning electron microscope operating at 10 kV with 1.5k magnifications in order to investigate phase morphology and miscibility of polymer blend.

3.3 Methodology

3.3.1 Preparation of PBT / Fasabond

Neat PBT and Fasabond are dried in oven at fixed temperature 60°C for 24 hr. Then prepare PBT and Fasabond blend at blend ratio 80/20, 70/30 and 50/50 PBT / Fasabond by putting into tumble mixer for premix then those materials are feed through twin screw extruder at processing temperature profile is 230°C, 245°C, 245°C and 245°C from feed zone to die area ,and screw speed is 40 rpm. After finishing from extruder, polymer blend extrudate is cut into pellet form by pelletizer.

3.3.2 Preparation of PBT / Fasabond (Master Batch)

Neat HDPE and Fasabond are dried in oven at fixed temperature 60°C for 24 hr. Then prepare HDPE and Fasabond blend at blend ratio 50/50 HDPE/Fasabond by putting into tumble mixer for premix then those materials are feed through twin screw extruder at processing temperature profile is 230°C, 245°C, 245°C and 245°C from feed zone to die area ,and screw speed is 40 rpm. After finishing from extruder, polymer blend extrudate is cut into pellet form by pelletizer.

3.3.3 Preparation of HDPE / PBT/ Fasabond

Neat HDPE PBT are dried in oven at same condition as first blend. Then prepare HDPE and PBT blend at certain blend ratio 80/20 HDPE/PBT without and with two set of compatibilizer 0, 1, 2.5, 5 and 10 phr by putting all material into

tumble mixer for premix then those materials are feed through twin screw extruder at the same processing condition as first blend. After finishing from extruder, polymer blend extrudate is cut into pellet form by pelletizer. The other series blend ratio at 70/30, 50/50, 30/70, 20/80 HDPE/PBT are also done

3.3.4 Preparation for impact and tensile testing

All blended polymer were formed by using injection machine, 40 tons BatterFeld with diameter of screw 22mm. The temperature profile for forming the dumbbell shape was 200, 210, 220 and 220 °C respectively except for pure PBT using 260, 285, 290 and 295°C under screw speed 265 rpm, pressure 80 bar. The mold temperature was 25-28°C and cooling time was 39 sec. Polymer blend dumbbell shape was used to do impact and tensile testing.