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Effect of compatibilizers on morphology, mechanical and thermal properties of polycarbonate/poly (butylene terephthalate) blends

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Blends of bis-phenol A polycarbonate (PC) and poly (butylene terephthalate) (PBT) show the unique combination of properties such as good chemical and stress cracking resistance, tensile strength, stiffness which make them very important class of material for various engineering applications specially in automobiles. But its low impact strength and moderate heat deflection temperature (HDT) make the use of blend in limited applications [1]. Most of the research work reported in the literature shows that the PC and PBT are partially miscible due to the possible trans-esterification reactions [2]. Compatibilizers provide the means by which the immiscible polymer blends can be modified and stabilized the morphology through reduction in interfacial tension between the two polymeric phases [3].In relation to this, we have studied the effect of three compatibilizers having different functionality on the various properties of Bis-phenol A polycarbonate (PC) and poly (butylene terephthalate) (PBT).

PC and PBT are melt-blended at 60/40 phr ratio with three different compatibilizers: ethylene acrylate-n-butylacrylate-glycidyl methacrylate terpolymer (E-BA-GMA), ethylene-n-butyl acrylate copolymer (E-BA), and random copolymer of ethylene and glycidyl methacrylate (E-GMA) at 3phr loading in a co-rotating twin screw extruder. The required test samples of uncompatibilized as well as compatibilized blends are injection moulded, and then the effects of compatibilizers on the morphology, mechanical and thermal properties of the PC/PBT blends are investigated.

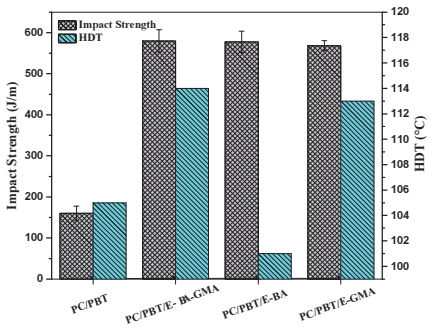

Figure 1: Effect of addition of compatibilizer on Impact Strength (J/m) and HDT (°C)

The results of mechanical properties test reveal that notched izod impact strength increased drastically (~ ten times), on addition of any one of the three compatibilizers and elongation at break (%) increase about 5, 3 and 4 times in case of E-BA-GMA, E-BA and E-GMA, respectively. While the other mechanical properties exhibit decreasing trends such as flexural strength and flexural modulus decrease by 3-5 %, and tensile strength also decreases by 5-8% on addition of any one of the compatibilizers. The HDT also increases about 8-9 ^{0}C on addition of E-BA-GMA or E-GMA while E-BA shows negative effect on HDT. Scanning electron microscopic examination of these four blends (as shown in figure-2) reveal that the PBT tends to disperse as larger domains in PC matrix of uncompatibilized PC/PBT blend. However, the size of the PBT domains in PC matrix reduce dramatically owing to the incorporation of all three compatibilizers separately. But the E-BA-GMA terpolymer results the smallest PBT domains in PC matrix (or the best morphology). The mechanical properties of PC/PBT compatibilized blends show that the effectiveness of E-BA-GMA terpolymer and E-GMA random copolymer is found almost equal. But at commercial scale, the use of ethylene terpolymer would be economically viable.

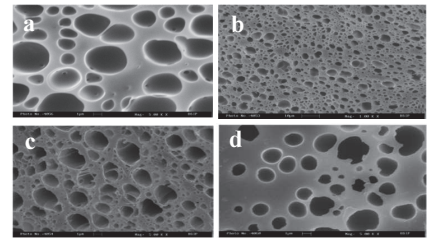

Figure 2: SEM Images of (a) PC/PBT blend, (b) PC/PBT/E-BA-GMA blend, (c) PC/PBT/E-BA, (d) PC/PBT/E-GMA

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