RESEARCH PAPER | Engineering | Volume : 3 | Issue : 2 | February 2013 | ISSN - 2249-555X

Assessing the Impact Performance of PC/ABS blends on addition of PC with Glass

KEYWORDS: Poly Carbonate (PC), Acrylonitrile Butadiene Styrene (ABS), PC with Glass, blending, mixing, impact strength.

T. Prudhvee Krishna
M.Tech Student, Department of Mechanical Engineering, Prasad V. Potluri Siddhartha Institute of Technology, Kanuru, Vijayawada – 520 007, Andhra Pradesh, India

N. Srinivasababu
Associate Professor, Department of Mechanical Engineering, Prasad V. Potluri Siddhartha Institute of Technology, Kanuru, Vijayawada – 520 007, Andhra Pradesh, India

N. Ramesh Babu
Senior Technical officer (STO), Central Institute of Plastics Engineering & Technology, Cherlapally, Hyderabad – 500 051, Andhra Pradesh, India

S. Adhikari
Technical officer (TO), Central Institute of Plastics Engineering & Technology, Cherlapally, Hyderabad - 500 051, Andhra Pradesh, India

ABSTRACT *In the present scenario the reuse of materials invites the development of new materials composed of various polymers in binary, tertiary and quaternary forms. In the present work Poly Carbonate (PC) and Acrylonitrile Butadiene Styrene (ABS) are blended at various proportions and the specimens are prepared for impact test as per ASTM standards. After studying the obtained results the performance of the blends under impact load is determined by incorporating PC with glass at various proportions.*

Introduction
Utracki defines the polymer blend as a mixture of at least two polymers or copolymers consisting more than 2 weight % of each macromolecular component. Depending on the strength of the free energy of binding, the components of the blends are miscible and immiscible [1]. Kallitsis et al. [2] studied the compatibilizer effectiveness for PET/HDPE blends and studied the mechanical characterization using dynamic mechanical analysis, tensile and impact testing. Kurtz et al. [3] examined the sensitivity of the small punch mechanical behavior to change in test conditions, such as loading rate and cyclic preconditioning. It was observed that the load-displacement curve was insensitive to cyclic preconditioning of the test specimen and only mildly sensitive to the loading rate. An important observation is that the determination of elastic point in polymer in small punch technique is very crucial and the elastic region was observed at very low displacement of 50 – 60 µm. Dimitrova et al. [4] observed that PP and HDPE blends are fragile materials because of incompatibility between the two phase systems. Compatibilization is necessary step to obtain blends with good mechanical and electrical barrier properties. Souza et al. [5] observed the role of reduction of particle size due to coalescence reduction for PP/HDPE blends and compared with each other blends. Rajan et al. [6] investigated PP as an isotactic – atactic stereo block content, molecular weight and possible strain induced crystallization. The moduli and tensile strengths of test materials were increased with percentage of isotactic pentad content and molecular weight.

Kanagaraj et al. [7] measured the parameters such as young's modulus, elongation at break, and toughness by reinforcing MWCNTs in to the HDPE matrix. It was reported that the toughness of the HDPE was increased by 32 % at 0.44 vol. % of MWCNTs in HDPE. Mendez et al. [8] examined the preparation of the blend and its modification with dicumylperoxide (DCP), which is a low molecular weight modifier know to produce chain scission in PP and cross-linking in HDPE during crosslinking process. Mourad et al. [9] investigated the effect of blend ratio of PE/PP (100/00, 75/25, 50/50, 25/75 and 0/100 wt. %) on tensile properties and hardness.

Jakel et al. [10] investigated the suitability of the small punch test for characterizing polythereterketone (PEEK) polymeric biomaterials for changes in material grade, crystallinity, and molding process. The PEEK sample was annealed at 200 0C and 300 0C and was compared with that of unannealed sample. They reported that the crystallinity of the polymer increased with annealing temperature. The peak load was also reported to enhance from 256 N for unannealed sample to 275 N for 300 0C annealed sample. However, the elongation at fracture, ultimate load and peak load were found to be reduced.

Materials and Specimens Preparation:
The two polymeric materials namely Poly Carbonate granules of grade 2407, makrolon, manufactured by Bayer, Thailand and Acrylonitrile Butadiene Styrene granules of grade HI121H, made by Ineos ABS (India) Ltd., Vadodara are purchased from Fathe Nagar, Hyderabad - 500 018.

The two materials are preheated in a Pre Dry Oven, Artic Aircon, Hyderabad at a temperature of 80 0C for a period of three hours. The preheated materials are blended manually for 3 – 4 min. The digital weighing machine is used to weigh the granules of various materials in predetermined quantity. The weighed material is placed in a hopper of an Automatic Injection Molding Machine, made by Japan Steel Works, Japan. Different temperatures are maintained for easy flow of material into the mold and are given in Table 1. In total seven compositions of the blends are taken in the present work.

TABLE 1. Composition of materials and their temperature during processing

S. No.	Material	Temperature Maintained (0C)
1.	100 % ABS (Virgin)	180 – 240
2.	10 % PC + 90 % ABS	280 – 320
3.	30 % PC + 70 % ABS	280 – 320
4.	50 % PC + 50 % ABS	280 – 320
5.	70 % PC + 30 % ABS	280 – 320
6.	90 % PC + 10 % ABS	280 – 320
7.	100 % PC (Virgin)	280 – 320

PC with Glass fiber is procured from Brakes India Limited, Mysore District, and Karnataka. Then Polycarbonate (PC) with glass fiber content of 30 % is mixed in different proportions in 50 % – 50 % PC/ABS blends. The composition of the materials and their processing temperature are given in Table 2.

Volume : 3 | Issue : 2 | February 2013 | ISSN - 2249-555X

Along with the Virgin PC with glass fiber in total six compositions are considered in the present work.

TABLE 2. Composition of materials and their temperature during processing

S. No.	Material	Temperature Maintained (0C)
1.	5 % PC with Glass + PC/ABS at 50 – 50%	260 – 290
2.	10 % PC with Glass + PC/ABS at 50 – 50%	260 – 290
3.	15 % PC with Glass + PC/ABS at 50 – 50%	260 – 290
4.	20 % PC with Glass + PC/ABS at 50 – 50%	260 – 290
5.	30 % PC with Glass + PC/ABS at 50 – 50%	260 – 290
6.	% PC with Glass (Virgin)	260 – 290

Initially the inner wall of the mold is sprayed with Anabond anti-spatter silicone spray to avoid sticking of the specimen to the mold. In the injection molding machine the material in the semi liquid state is injected into the mold at a pressure of 40 bar, machine speed of 45 rev/min and shot capacity of 25 mm for every specimen. The material is allowed to solidify for 2 – 3 minutes and the test specimens are taken out from the mold manually with care. The projections on the specimens are removed using sharp knife and are cleaned and ground to the required dimensions as per ASTM D 256 – 10. The fabricated specimens are shown in Fig. 1.

Fig. 1 Impact Test Specimens

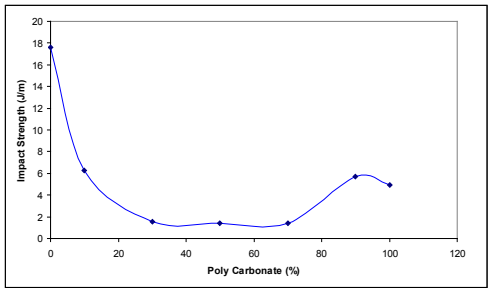

Fig. 2 Impact strength of PC/ABS blends at various compositions

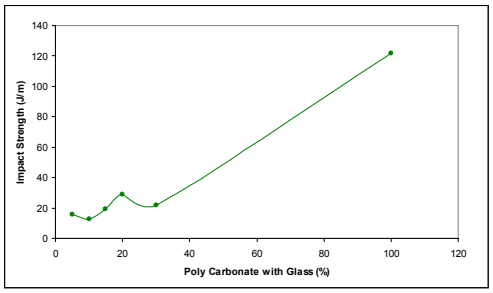

Fig. 3 Impact strength of PC/ABS blends at various compositions of PC with glass

Results and Discussion:

With increase in polycarbonate content in ABS the impact strength shown decreasing trend up 70 % of PC and then it is increased, shown in Fig. 2. The virgin PC impact strength is much lower than ABS and thereby decrease in strength is an expected result but the impact strength at 90 % PC and 10 % ABS composition is more than the Virgin PC impact strength. In order see the performance of the PC/ABS blends, PC with glass fiber is added at various compositions and the results of impact strength is shown in Fig. 3. With the addition of PC with glass in the blends, resulted in the improvement of impact strength up to 20 % of PC with glass except at 10 % content, but the virgin PC with glass shown highest value of impact strength as 121.81 J/m.

REFERENCE 1. M. P. Brown and K. Austin, Handbook of Polymer Blends and Composites, Volume 3, iSmithers Rapra Publishing, 2003, pp. 1. | 2. J. K. Kallitsis, N. K. Kalfoglou, D. S. Skafidas, Polymer 36, 4453-4462 (1995). | 3. S. M. Kurtz, J. R. Foulds, W. J. Charles, S. Srivastav, A. Edidin, Biomat. 18, 1659-1663 (1997). | 4. T. L. Dimitrova, F. P. Mantia, M. Toselli, A. Valenza, A. Visco, Polymer 41, 4817-4824 (2000). | 5. A. M. C Souza, N. R. Demarquette, Polymer 43, 3959-3967 (2002). | 6. G. S. Rajan, T-Vu. Yen, J. Mark, C. Myers, European Polymer J 40, 63-71 (2004). | 7. S. Kanagaraj, F. Varanda, T. V. Zhiltsova, M. S. A. Oliveira, J. A. O. Simoes, Compo. Sci. and Tech. 67, 3071-3077 (2007). | 8. J. M. Mendez, Ph.D Thesis work, Cochin University October (2009). | 9. A. H. Mourad, Mat. and Des. 31, 918-929 (2010). | 10. D. Jakel, D. Mac, S. M. Kurtz, J. of Beha. Biome. Mat. 4. 1275-1282 (2011).