Investigation of Mechanical Properties of Acrylonitrile butadiene styrene and styrene butadiene styrene Blends

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Abstract In *this particular piece of research, the morphology, impact strength, and tensile at a yield of ABS/SBS mixes were investigated. The melt blending technique was utilized in the preparation of the blends. The findings of the SEM analysis showed that the eventual morphological features of blends are dependent on the composition of the SBS. In mechanical tests, it was shown that the tensile at yield declined as the SBS content increased, and that the impact strength improved at low extents of SBS before decreasing as the SBS content increased.*
Keywords: Yield stress, Izod, SEM

1. Introduction

Mechanical properties investigation including stresses, modulus of elasticity, tensile strength, elongation, hardness, and fatigue are of significant importance. In fact, these properties are criteria to monitor material health and consequently avoiding unwanted situations [1-4]. Recent years have seen an uptick in the number of researchers interested in polymer mixing for the purpose of obtaining materials with novel and enhanced properties [5-6]. ABS is the most extensively used thermoplastic among polymers due to the ease with which it may be processed, its relatively low cost, and its dimensional stability. Despite the fact that certain grades of ABS do not possess adequate impact strength, particularly when the temperature is low. It is possible to improve the resistance of polymers to impact by combining them with an elastomer in the appropriate proportions. In comparison to other types of rubber, the thermoplastic elastomer known as SBS possesses superior characteristics in terms of thermal stability, resistance to impact, and cost. The incorporation of SBS into blends or homo-polymers, such as PE/PS or PP, can, according to the findings of a number of researchers [7-8], result in improved mechanical properties. This research will evaluate the morphological and mechanical features of ABS/SBS composites in order to better understand their applications.

2. Experimental Procedure

The using acrylonitrile butadiene styrene (ABS) has a melt flow index (MFI) of 1.8 (g/10 min) and an Izod of 20(KJ/m2). Styrene-Butadiene-Styrene (SBS) 411-LG was utilized in this study as well. It had an MFI of less than one (g/10 min), and its S/B ratio was 31/69. The mixtures were put together with the assistance of a twin-screw extruder SM PLATEK operating at a speed of sixty revolutions per minute for each screw. Table. 1 presents an illustration of the temperature profile that runs along the length of the extruder barrel.

Table 1. Profile of the temperature along the extruder

Barrel zone 1 (°C)	Barrel zone 2 (°C)	Barrel zone 3 (°C)	Barrel zone 4 (°C)
195	215	225	225

Tests for tensile strength and Izod impact were carried out in accordance with ASTM Specifications D638 and D256, respectively. Tests of tensile strength were carried out using a universal tensile machine that was outfitted with a 10 KN load cell. The speed of the crosshead was set to 2 millimeters per minute. Every experiment was run at a temperature of 20 degrees Celsius. V-notched samples were used for the Izod impact tests, which were carried out using a 5 hummer. The KYKY model EM 3200 and the TESCAN model MIRA3 were used for the scanning electron microscopy (SEM) examinations that were conducted on the morphological investigations. In order to prevent any phase deformation from occurring during the cracking process, the samples intended for SEM were broken in liquid nitrogen.

3. Results and Discussion

Micrographs produced from the cracked surfaces of ABS and ABS/SBS composites while they were stored in liquid nitrogen are presented in Figure. 1. Rubber phase in the samples having less than 3 percent of SBS is disseminated as droplets in the ABS, and sufficient compatibility can be seen between the various components of the blend. Agglomeration of the rubber phase takes place when the percentage of SBS increases. The findings in [8] were consistent with one another. Micron-sized rubber particles were found in the samples that contained 5 and 10 percent SBS. These particles cause weak adhesion between the phases and a non-uniform dispersion of rubber particles. The cavitation of rubber particles during the fractioning process is what's responsible for the voids shown in the SEM micrographs.

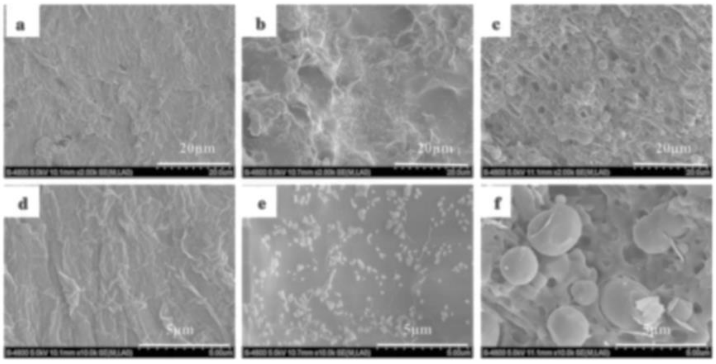

Fig.1. SEM micrographs of ABS/SBS blends

The yield tensile strength of blends is displayed in Fig. 2. When there is only a small quantity of SBS present, there is not a substantial difference in the tensile at yield. Due to poor adhesion between phases, yield stress decreased as SBS content increased. This was the cause of the decrease. This results in a decrease in the component's yield strength and a reduction in the amount of stress that is transferred at the interface between the components. The Izod impact strength of blends is shown in Fig. 2, which depicts an increase in SBS. By adding 5 percent and 10 percent SBS to ABS, the material's impact strength was significantly enhanced. Because of the well-dispersed rubber particles in ABS and the encouragement of rubber particle cavitation, the shear deformation in the SAN matrix is increased, which leads to an increase in the impact strength of the material even though it contains a low percentage of SBS. The ideal range for the size of rubber particles, which would result in increased impact resistance, is between 250 and 400 nanometers (nm), as illustrated in figure 1-b. Because of the coalescence of scattered rubber particle domains, the impact strength of ABS was reduced when it was present in an amount of SBS that was greater than 4 percent by weight.

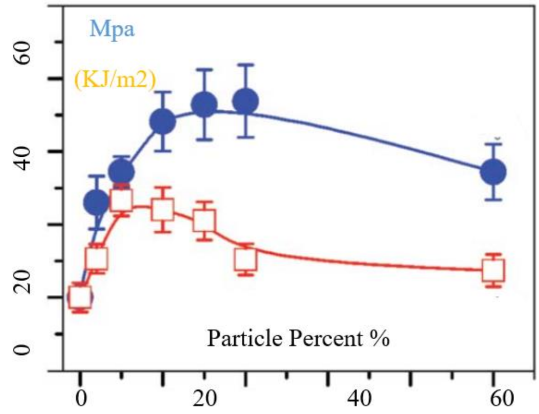

Fig.2. Mechanical properties of blends: tensile at yield and Izod impact strength

4. Conclusion

The use of a twin-screw extruder was necessary in order to complete the preparation of ABS/SBS mixes. The dispersion of rubber particles in the matrix is impacted by the concentration of SBS in the mixture. According to the findings of the SEM analysis, SBS particles dispersed equally in the SAN at low proportions of SBS; nevertheless, there is agglomeration for 5 percent wt SBS and higher. According to the results of the mechanical testing, the impact strength increased when there was a low level of SBS but thereafter decreased. As the percentage of SBS increased in the ABS, the tensile strength at yield dropped.

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