Abstract. To explore the influence of different compatibilizers on the strength of ABS/PMMA, two groups of tests were performed. Polymers were mixed by melt blending, and then the ternary blends were tested. SMA makes the tensile strength and impact strength of ABS/PMMA blends decrease obviously, while SBS improves the two properties except the addition of 2wt%. The results of different compatibilizers on ABS/PMMA blends were unlike.

Keyword. ABS; PMMA; compatibilizer; tensile strength; impact strength

1. Introduction

Blending modification is a convenient and effective method that makes materials possess the excellent properties of each part and satisfy different demands from different domains. As engineering plastic, acrylonitrile-butadiene-styrene (ABS) has nice toughness, hardness and rigidity. Good mechanical and processing properties make ABS widely used in many fields [1]. Poly (methyl methacrylate) (PMMA) has good optical property and light aging performance. Although the blends of ABS and PMMA increase heat resistance of ABS and notch impact strength of PMMA, different mixed degrees have great impact on the nature of the blend as shown by studies in the past decades [2-4].

The compatibility between ABS and PMMA will affect the nature of the blends clearly [5, 6]. In this case, the increase of compatibility has been studied in the past few years [7]. According to the principle of dissolution in the similar material structure, addition of compatibilizer can improve the performance of polymer [8]. In this study, two compatibilizers were used to explore the effect of mechanical properties on ABS/PMMA blend to explore the different power on polymer by different compatibilizers.

2. Experimental

2.1 Materials

A commercial ABS resin (757K) and PMMA resin (CM-211) from Zhenjiang Chimei Chemical Co., Ltd were used for the matrix. Two different compatibilizers were used in the study: styrene maleic

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anhydride (SMA) and styrene-butadiene-styrene (SBS), all from Dongguan AnChen plastic technology Co., Ltd.

2.2 Preparation

Prior to use, ABS, PMMA and SMA were dried at 80°C, while SBS was dried at 60°C for 12 h in an air circulating oven. Then, ABS/PMMA was mixed with SMA and SBS, respectively, in a co-rotating twin extruder with a screw diameter of 21.7 mm and a length to diameter ratio of 40. Temperature was set range from 200°C to 225°C from hopper to die and the speed was 150 rpm. The extruded was injected into molding machine after granulation and drying at 80°C for 12 h again. The dumbbell-shaped test piece for tensile test was 150 mm in gauge length, 10 mm in width and 4 mm in thickness; the rectangular test simple was 80 mm long, 10 mm wide and 4 mm thick for impact tests.

2.3 Characterization

The tensile and Izod impact tests were performed on CMT 5305 electrical testing machine at a crosshead speed of 4 mm/min and XC-5.5D impact tester, respectively.

3. Results and discussion

3.1 Effect of SMA content

The styrene-acrylonitrile copolymer (SAN) of ABS has good compatibility with SMA, and SMA can be incorporated into PMMA, because the phenyl of SMA has strong interaction with carbonyl of PMMA. Hence, SMA can increase the compatibility between ABS and PMMA. From previous experience, the blends of ABS/PMMA, at 80/20, have the best comprehensive mechanic performance, by adding SMA into the blends to improve its performance.

![Fig.1. Effect of SMA on tensile strength of ABS/PMMA blends](image1)

![Fig.2. Effect of SMA on Izod impact strength of ABS/PMMA blends](image2)

As Fig.1 shows, the blends’ tensile strength decreases with the increase of SMA, so does its impact property, as seen in Fig.2.

The ternary mixture was ABS and PMMA at a ratio of 80 to 20, with the SMA content of 0.5wt%, 10wt% or 15wt%. The two figures above indicate that SMA did not toughen ABS/PMMA blends, but obviously lower its performance. This may be caused by the rigidity of maleic anhydride in SMA. Maleic anhydride possesses cyclic structure, and this made the tensile strength and impact property decrease [9]. The macroscopic phenomena indicated that as the compatibilizer of ABS and PMMA, SMA cannot increase their compatibility.
3.2 Effect of SBS content

The butadiene of SBS presents rubber elasticity, and this can promote the impact strength of polymer. The styrene part owns high temperature liquid, and this nature makes the machinability of polymer easier. In addition, butadiene and styrene are also parts of ABS. According to this, SBS can be the compatibilizer of ABS and PMMA [10]. Under the ratio of 80 to 20 of ABS and PMMA, SBS was added at 0, 2wt%, 4wt%, and 6wt%.

After a series of performance tests, the result can be seen as follows.

The tensile strength of ABS/PMMA blends dropped with SBS added before the SBS content reached 2wt%, and then kept increasing as SBS increased, while the impact strength of the blends kept increasing with the increase of SBS, as showed in Fig.4, except the addition of 2wt%.

As seen above, SBS differs from SMA clearly. The phenomenon may be that SBS does not work as compatibilizer but toughener. The parts of SBS, Styrene and butadiene, enhance the strength of the ABS/PMMA blends. When the volume addition of SBS is little, SBS may affect the compatibility of the blends, and this leads to decline of tensile and impact strengths. With the content increasing, the function of toughening is in a dominant position, hence, the polyline of the strength goes up.

4. Conclusions

The two compatibilizers, SMA and SBS, play very differently in the blends; SMA makes tensile strength and impact strength of ABS/PMMA blends decrease obviously, while SBS improves the two...
properties except the addition of 2wt%. It is to be explored whether SMA and SBS promote the compatibility between ABS and PMMA or not.

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