Morphology and Thermal Properties of PPS/ABS Blend Systems

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ABSTRACT: In this study the PPS/ABS blend system was investigated in order to collectively identify the relationship among blend morphology, chemical compatibilization, and thermal property. The ABS resin was chemically modified by the incorporation of maleic anhydride through reactive extrusion for enhanced compatibilization, and ABS/PPS and the modified ABS/PPS blends were prepared by a twin-screw extruder. The effect of chemical modification of ABS on the morphological, mechanical, and thermal properties of the resulting blend was examined. A strong chemical interaction between PPS and MABS was observed by optical microscopy, scanning electron microscopy, and FTIR. The PPS/MABS blend showed a single glass-transition temperature in dynamic mechanical analysis, demonstrating pseudo-homogeneous phase morphology induced by chemical compatibilization. The PPS/MABS blend also exhibited an enhanced thermal stability and heat distortion temperature compared with the PPS/ABS blend. © 2002 Wiley Periodicals, Inc. J Appl Polym Sci 87: 661–665, 2003

Key words: PPS/ABS blend; MABS; compatibilization

INTRODUCTION

Poly(phenylene sulfide) (PPS) is a very stiff crystalline polymer in which sulfur and 1,4-phenylene groups are perfectly alternating. PPS has a glass-transition temperature of 80°C–90°C and a melting temperature of about 280°C. It has excellent dimensional stability, high stiffness, high modulus, chemical resistance, and fatigue resistance, which collectively make it comparable to metals.1,2 For this reason, PPS has been increasingly applied to areas requiring high temperature and chemical resistance as well as to electrical, electronic, and automobile parts.3,4 However, it should also be mentioned that PPS is brittle with low elongational strain, exhibiting a slow crystallization rate and low impact strength. Furthermore, chemical modification of PPS is extremely difficult. For the practical application of PPS, it is necessary to reduce the brittleness while maintaining its advantageous thermal, mechanical, and chemical properties.

To enhance the physical properties of PPS, several techniques have been applied. A crosslinking structure has been introduced to enhance the properties in order to increase the stiffness under high temperature in the presence of oxygen.5 Composite materials have also been prepared using carbon and glass fibers as reinforcement,6 and blend systems using liquid crystalline polymers were also introduced to enhance its mechanical properties.7,8 Also, CO2 has been used as a plasticizer to decrease the melting point of PPS during melt processing.9

ABS resin is a copolymer of styrene, acrylonitrile, and polybutadiene and is a multiphase polymeric resin with butadiene rubber distributed as relevant-sized particles in the SAN matrix. ABS resin has been widely utilized in various areas because of its excellent properties such as the processibility of styrene, the chemical resistance of acrylonitrile, and the flexibility and impact property of butadiene.10 Therefore, ABS resin is often utilized in the electricity, electronics, office machine, automobile, miscellaneous products, and construction materials areas. However, it has been pointed out that ABS has poor heat and ozone resistance because of the unsaturation of the butadiene moieties. To solve this problem, acrylic rubber, EPDM, or chlorinated PE has been replacing butadiene rubber; it has also been reported that heat resistance may be supplemented by blending with such excellent heat-resistant resins as a polycarbonate consisting of an aromatic ring.11–13

It was our aim to enhance the physical properties of PPS and ABS by the preparation of a novel PPS/ABS blend. In the preparation of PPS/ABS blend systems, ABS resin was chemically modified to enhance its compatibility. The ABS resin was chemically modified by reacting ABS with maleic anhydride (MAH) using