Melt rheological behavior and batch foaming of modified PMMA

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Abstract

The heat resistance of poly(methyl metacrylate)(PMMA) can be enhanced by blending styrene-methyl methacrylate-maleic anhydride copolymer (SMA) which is compatible with PMMA, without substantially changing the mechanical properties of original PMMA. Here from the viewpoint of the prozessability of the blends, we studied the rheological properties and foaming behavior by using CO2 as a foaming agent.

We used commerical PMMA (M_w = 100,000 and Tg = 108 ^oC) and SMA (M_w = 160,000 and Tg = 132 ^oC). SMA/PMMA (50/50 wt%) blend (B50) was extruded by a single screw extruder (φ=40mm) at 240 ^oC and screw rotation speed of 100 rpm. The blend was transparent and considered to be compatible (Mw 140,000, Tg 120 ^oC).

CO_2 was absorbed to the sheet samples in the pressure vessel of 25 ^oC for 8 hr. Adsorption pressure was adjusted so that CO_2 concentration of each specimen was to be 14 wt%. After the saturation, samples were soaked in the oil bath for 1 min to induce foaming at Tg + 10 ^oC for each specimen (SMA: 142 ^oC, B50: 130 ^oC, PMMA: 118 ^oC). Then, samples were cooled in the water bath of 15 ^oC for 1min.

Fig.1 shows SEM images of PMMA, B50, and SMA foamed at Tg+10 ^oC and 15MPa of CO_2. SMA indicated much smaller cell size than that of PMMA, the blends B50 also showed fine cells. Fig.2 summarizes the change in the cell diameter *d* and the expansion ratio E_r as a function of the blend ratio of SMA. Although *d* simply decreased as increasing the SMA content, E_r showed an increase with the SMA content and reached a peak at 50 wt% (B50). Above the peak, E_r was decreased.

We also studied rheological behaviors, such as extensional viscosity and dynamic viscoelasticity, to discuss the foamabilities of SMA and SMA/PMMA blend. This will be presented at the conference.

Keywords :" Carbon dioxide", "foaming", "modified acrylic copolymer"

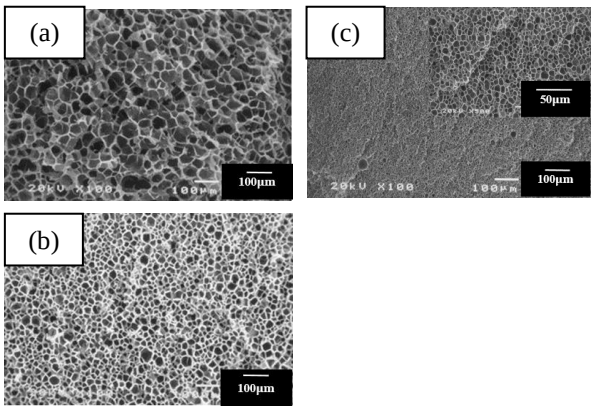

Fig.1 SEM images of foams with CO_2 at Tg+10 ^oC: (a) PMMA , (b) B50, and (c)SMA

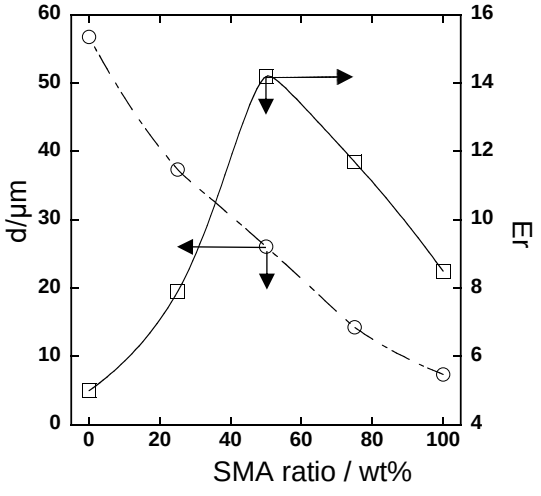

Fig.2 Effect of PMMA/SMA composition on average cell diameter *d* and expansion ratio *Er*.