15A, 2007G524

Nanophase-separated structures of AB block copolymer / C homopolymer blends with hydrogen bonding interaction

Atsushi Takano, Katarzyna Dobrosielska, Sou Wakao, Daisuke Kawaguchi and Yushu Matsushita
Department of Applied Chemistry, Nagoya University, Furo-cho, Nagoya 464-8603, Japan

Introduction

The block copolymers consisting of incompatible polymers form self-assembled structures in bulk[1], such as spherical-, cylindrical-, bicontinuous- and lamellar ones depending on their compositions. Polymer blends of AB/B type also show the same morphological change with composition, however amounts of the homopolymer solubilized into corresponding domains of AB block polymer are limited. [2] In this study morphology of AB/C polymer blends with attractive interactions such as hydrogen bonding interaction was investigated by transmission electron microscopy (TEM) and small-angle X-ray scattering (SAXS).

Experimental

poly(styrene-*b*-2-vinylpyridine) diblock copolymer (SP, M_w=130K, weight fraction of polystyrene w_s=0.67), poly(2-vinylpyridine) (P, M_w=3K), and poly(4-hydroxystyrene) (H, Mw=8k) were used as component polymers. Blend sample films of SP/P and SP/H were prepared by solvent casting from THF solutions and annealing at150°C for 5 days under vacuum.

Results&Discussion

The morphology of parent SP diblock copolymer shows hexagonally-packed cylindrical structure. As P was added to the SP the blend's morphology transfered to lamellar ones. However addition of more P homopolymer causes macrophase separation, as shown in Figure 1. In contrast, in SP/H blends, macrophase separation of their components did not exist and various nanophase separated structures were observed in wide composition range as shown in Figure 1and 2. It is due to miscibility of P and H via hydrogen bonding interactions, which are considered as the driving force producing uniform nanophase separated structures in wide composition range.

References

[1] Y. Matsushita *J. Polym. Sci. Part B: Polym. Phys.* 38, 1645 (2000).
[2] T. Hashimoto et al. *Macromolecules*, 24, 240 (1991)

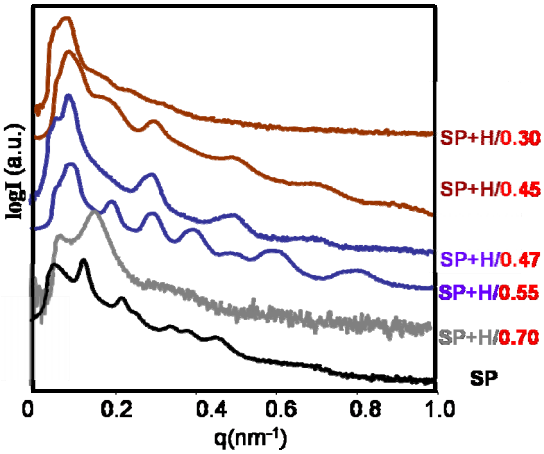

Figure 2. SAXS patterns of SP/H blends

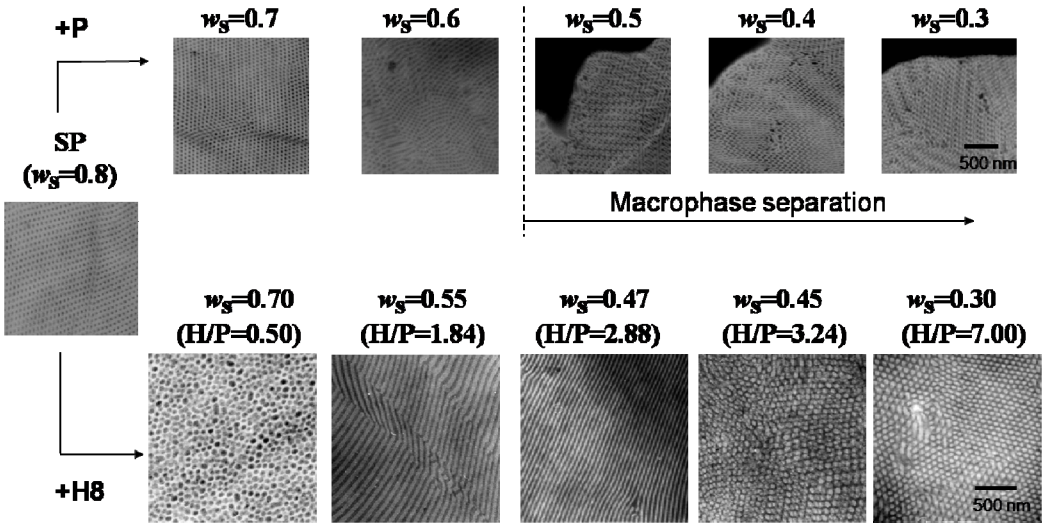

Figure 1. TEM images of SP/P blends and SP/H blends