

## Abstract

This work is a part of the project of our department, where we focus on synthesis and properties of derivatives of block copolymers made of styrenes and methacrylates.

Here we investigate the combination poly(4-octylstyrene) and poly(*n*-butyl methacrylate) which, according to our opinion, has great potential in being usable in various applications. Because of high incompatibility of the components, which makes easier the (micro)phase separation, the system can be used for both the nanotechnology and for the fundamental research.

The work started by anionic polymerization of a series of homopolymers and nearly-symmetric diblock copolymers. The products were isolated and characterized by GPC and DSC methods. We also tried to obtain temperatures of order-disorder transition (ODT) characteristic of symmetric copolymers, however, because of the unsuitable grain structure combined with strong incompatibility of the blocks, it was found that the ODT temperature was out of the measurement range.

After that we focused on a study of bulk properties of diblock copolymers using small-angle X-ray scattering and transmission electron microscopy. In these experiments we confirmed regular lamellar organization in all samples, which corresponds to the theoretical predictions resulting from the phase diagram of diblock copolymers.

In the next part of the work we used atomic force microscopy for a systematic study of thin copolymer layers and their modifications by vapor-treatment, using simple organic solvents. The vapor-treatment is a useful method to change actual topographical and/or microphase arrangement of thin films. Here we tried to find a relation between the solvent quality for diblock copolymer components and the resulting structure. According to our results, in order to get a structured surface, it is suitable that the solvent has at least a weak interaction (solubility or swelling) for both homopolymer chains. Using thermodynamically "good" solvents had no effect in our cases, to the contrary with results in some other publications dealing with different systems. We also confirmed that using suitable solvents it is possible to obtain parallel or perpendicular arrangement of final structures, with respect to the supporting substrate.

Besides of thin layers of the "pure" diblock copolymers, the thin films of ternary blends of a diblock copolymer with corresponding homopolymers were investigated. Here we focused on the surface behavior of the mixtures with composition near the tricritical Lifshitz point, which – because of the possibility to form bicontinuous microemulsions – is an often studied composition for its potential usability in material science. All of the found published comparable studies, however, deal with the behavior of bulk systems, so our thin films-

focused experiments can be, as we believe, interesting as the starting point of the next potential studies of the thin films of ternary polymer systems.

In the last part of the work, the dynamic behavior of diblock copolymer solutions in mixtures of two partially miscible solvents A and B was studied by dynamic light scattering (DLS) and small angle X-ray scattering (SAXS); A was selective solvent for one copolymer block and B for the remaining one. Using DLS, we found a number of temperature and concentration dependent dynamic processes which correspond to published ones for solutions of similar diblock copolymers. Using SAXS, we confirmed the presence of hollow micelles which consist of the core ("drop") of A-rich phase (minority solvent) covered with the shell of the diblock copolymer located in B-rich phase (majority solvent). This finding is important since allow us prepare hollow micelles, which can play an important role in theoretical studies or practical applications; e.g., as nanocontainers.