NOVEL THERMOSTABLE POLY(HIPEs) OF POLYSTYRENE/POLYCYANURATE *IN SITU* SEQUENTIAL IPNs

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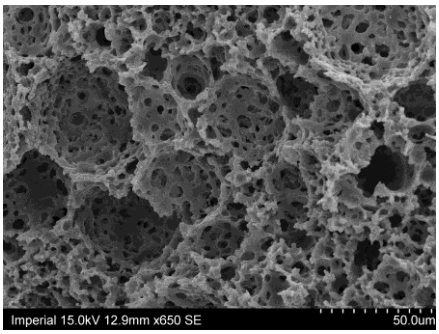
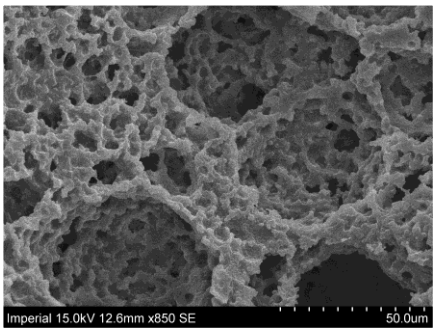
ABSTRACT

In recent years high internal phase emulsions (HIPEs) with a continuous organic phase consisting of monomers, crosslinker and an emulsifier gained increasing interest. HIPEs are commonly defined as emulsions in which the dispersed phase occupied more than 74% of the emulsion volume, i.e. more than the maximum packing fraction for identical spheres. The polymerisation of the monomer phase of the emulsion, which can be oil or aqueous phase, leads to the formation of highly porous (up to 95%) low density polymer foams, so called poly(HIPEs) [1]. Recently, first publications have appeared on poly(HIPEs) based on interpenetrating organic-inorganic networks [2]. By this way the best properties of two different polymer networks are combined in one material [3]. So two very interesting modern synthetic (polymerization) approaches, poly(HIPEs) and IPNs, are involved in methodology of such materials (foams) creation. In our work first the polystyrene (PS)/polycyanurate (PCN) thermostable highly porous foams of low density have been developed using methods of HIPE polymerization and synthesis of *in situ* sequential organic-organic IPNs. All the components (styrene, tri(oxyethylene)-α,ω-dimethacrylate (crosslink agent), dicyanate ester of bisphenol E (DCBE), needful catalysts, initiators of polymerization, emulsifier and water) were mixed first, then the PS poly(HIPE) network was synthesized at 75 ^{o}C for 24 h, after that the DCBE monomer was cured to PCN network inside the PS poly(HIPE) network by step by step heating at 150-250 ^{o}C for 15 h. Chemical processes were monitored by FTIR spectroscopy method. Strong influence of PCN component on phase structure, thermal behavior and viscoelestic properties of PS polyHIPEs has been observed. The final polyHIPEs of different composition of polystyrene/polycyanurate *in situ* sequential IPNs maintain high porosity and low density inherent to conventional PS polyHIPEs and are characterized by higher thermal stability compared to the pure PS poly(HIPE) foam. In the photographs below you can see a typical view of the porous structure of PS/PCN poly(HIPEs) obtained.





References

(1) Silverstein, M.S.; Tai, H.; Sergienko, A.; Lumelsky Y.; Pavlovsky, S. *Polymer* **2005,** *46(7)*, 6682–6694.
(2) Tai, H.; Sergienko A.; Silverstein, M.S. *Polymer* **2001,** *42*, 4473-4482.
(3) Grigoryeva, O.; Fainleib, A.; Sergeeva, L.M. in „*Handbook of Condensation Thermoplastic Elastomers"*, editor S. Fakirov, WILEY-VCH, Germany, **2005**, *Chapter 12*, p. 325-354.