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Thermal Characterization of Novel Block Copolymer Systems

Theodore Sentoukas¹, Despoina Giaouzi¹, Stergios Pispas¹

¹Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation, Athens, Greece

<mailto:sentoukat@eie.gr>

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Abstract

Thermal analysis techniques are of critical importance in studying the phase separation in block copolymer systems [1]. The primary goal of this study is to investigate the thermal stability, micro/nano-phase separation and secondary molecular interactions of Poly(Dimethylaminoethyl Methacrylate)-*b*-Poly(Hydroxypropyl Methacrylate) (PDMAEMA-*b*-PHPMA) and Poly(N-Isopropylacrylamide)-*b*-Poly(Oligo(Ethylene Glycol) Acrylate) (PNIPAAm-*b*-POEGA) novel copolymer systems in the bulk state using Differential Scanning Calorimetry (DSC), Thermogravimetry Analysis (TGA) and FTIR Spectroscopy. PDMAEMA-*b*-PHPMA is a pH and double thermo-responsive block copolymer system which forms various nanostructures when inserted in aqueous media with different solubilization protocols [2]. Thermal analysis measurements conducted in the bulk state show hints of nano-phase intermixing and hydrogen bonding between the hydroxyl group of PHPMA block and the tertiary amine of PDMAEMA group. The latter was also confirmed by FTIR spectroscopy. TGA measurements indicate dependence of the decomposition temperature on the copolymer nature. On the other hand, PNIPAAm-*b*-POEGA is a thermo-responsive block copolymer system. The results show considerable nano-phase separation by exhibiting two distinct T_g s, as the hydrogen bonding between the oxygens of the POEGA block and the amide groups of the PNIPAAm block is weaker than in the previous system. In conclusion, these techniques were found to be extremely valuable in determining both thermal stability and micro/nano-phase mixing/separation of both block copolymer systems.

References

- [1] Penco M., Sartore L., Bignotti F., D'Antone S., Di Landro L., European Polymer Journal 36 (2000) 901-908
- [2] Sentoukas, T. and Pispas S.: Poly(Dimethylaminoethyl Methacrylate)-*b*-Poly(Hydroxypropyl Methacrylate) Copolymers: Synthesis and pH/Thermo-Responsive Behavior in Aqueous Solutions, J. Polym. Sci. Part A: Polym. Chem. doi: 10.1002/pola.29082

