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Investigation of the thermal and thermo-mechanical properties of polyurethanes based on amino ethers of boric acid

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Abstract

A method for the modification of the hyperbranched structure of amino ethers of boric acid (AEBA) with bifunctional and trifunctional adducts based on diglycidyl ether of 4,4'-dihydroxy-2,2'-diphenylpropane and monoethanolamine (EM) and on the basis of diglycidyl ether of 4,4'-dihydroxy-2,2'diphenylpropane and monoethanolamine with boric acid (EMB) was studied to control the macromolecular and supramolecular structure of amino esters of boric acid (AEBA). Based on the modified with EM AEBA and aromatic polyisocyanates, film polymer materials were obtained (AEBA-EM-PU) and it was found that their thermal stability depends both on the degree of its branching and on the content of modifying adducts in AEBA composition. Based on AEBA, modified EMB and aromatic polyisocyanates, film polymer materials were also obtained (AEBA-EMB-PU).

The analysis of thermo-mechanical properties with thermal stability allows to conclude that the formation of AEBA-EM-PU is accompanied by processes of supramolecular organization involving the flexible-chain component, which is PEG. The polyoxyethyleneglycol with nine oxyethylene units is small in size, which leads to difficulties in segregation and microphase separation in mesh and even in block polymers. Nevertheless, investigated AEBA-EM-PU allows to create such possibilities for this unification. This is evidenced by the manifestation and relatively low temperatures of the onset of segmental mobility for the obtained AEBA-EM-PU, which are identified polymers. The nonadditive dependence for temperature of the α-transition on EM content in the AEBA-EM-PU is a consequence of the hierarchical nature of the supramolecular organization, which is due to the structural features of the EM.

References

[1] M. Ulbricht. *Polymer*. **2006**. Vol.47. P.2217-2262.
[2] P. Escalé, L. Rubatat, L. Billon, M. Save. *Eur. Polym*. J. **1999**. Vol.48. P.1001-1018.
[3] F.S. Bates, M.A. Hillmyer, T.P. Lodge, C.M. Bates, K.T. Delaney, G.H. Fredrickson. *Science*. **2012**. *Vol.*336. *P.*434-440.
[4] B.H. Jones, T.P. Lodge. *Natur*e. **2012**. Vol.44. P.131-139.
[5] J.H. Lee, Y. Kim, M.Y. Ha, E.K. Lee, J. Choo. *J. Am. Soc. Mass Spectrom.* **2005**. Vol.16. P.1456.
[6] J.N. Cambre, B.S. Sumerlin, *Polymer*. **2011**. Vol.52. P.4631-4643.
[7] W. Yang, X. Gao, B. Wang. *Med. Res. Rev.* **2003**. Vol.43. P.346-368.
[8] W.L.A. Brooks, B.S. Sumerlin. *Chem. Rev.* **2016**. Vol.116. P.1375-1379.
[9] W. Niu, C. O'Sullivan, B.M. Rambo, M.D. Smith, J.J. Lavigne. *Chem. Commun.* **2005**. Vol.34. P.4342-4344.
[10] F. Jäkle, *J. Inorg. Organomet. Polym.Mater*. **2005**. Vol.15. P.293-307.
[11] I.M. Davletbaeva, O.Yu. Emelina, I.V. Vorotyntsev, R.S. Davletbaev, E.S. Grebennikova, A.N. Petukhov, A.I. Ahkmetshina, T.S. Sazanova, V.V. Loskutov. *RSC Adv*. **2015**. Vol.5. P.65674-65683.
[12] M.N. Kayumov, I.M. Davletbaeva, O.O. Sazonov, R.G. Ibragimov, A.A. Nizamov. *Bulletin of Kazan Technological University*. **2017**. Vol.20. No.17. P.36-38.