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RAPID SYNTHESIS OF A NOVEL TYPE THERMOSTABLE POLY(ETHER)-B-POLY(AMIDE) (PEBA) WITH WELL-DEFINED ARAMIDE SEGMENTS, AND THE APPLICATION TO SHAPE MEMORY MATERIAL

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Poly(ether-*b*-amide) multiblock copolymers (PEBA) are a class of important thermoplastic elastomers (TPE) s, due to the tuneable properties with variable polyether soft segments (SS)s that realizes the reliable mechanical strength. We have studied packing behaviour of a series of N-alkylated polyamides1)-2) and polyimines3), and recently developed a rapid synthetic strategy of a novel type PEBA consisting of monodisperse poly(4-*N*-methyl benzamide) (PMBA) with poly(propylene oxide) (PPO). The resulting block copolymer shows phase-segregated structure with two distinct glass transition temperatures (T_g)s of -65 and above 50°C. Considering the experimental results of no phase segregation of the copolymer based on polydisperse PMBA (M_w/M_n > 1.4) with PPO, the monodisperse PMBA segment should play a critical role in the phase separation behaviour. The soft segment was then replaced from amorphous PPO into crystalline poly(ethylene glycol) (PEG), resulting in considerably distinctive phase segregation behaviour, probably due to the foreclosing effect of PEG crystal phase to PMBA segment. The dual crystalline phases realize a novel shape memory polymer (SMP) as depicted in Figure 1. In our system, the temporally shape is formed at above 60°C (melting temperature (T_m) of PEG), and fixed below the temperature. Once the material is heated above the temperature, the original shape is promptly recovered. It is noticeable that the T_m of PMBA was increased from 208 to 232°C in DSC 1st and 2nd measurements while the T_m of PEG was almost same at 52°C. The annealing of the block copolymer was performed from 200 to 240°C, affording the promotion of the higher crystalline state of PEG segment. The polarized optical microscope observation indicated the growth of the PEG crystal in this annealing treatment. The finally obtained SMP film of the block copolymer shows the tensile modulus, strength, and elongation at breaks of 233 MPa, 10 MPa, and 100%, respectively. The properties of SMP were controllable with the change of two segments within the block copolymer.

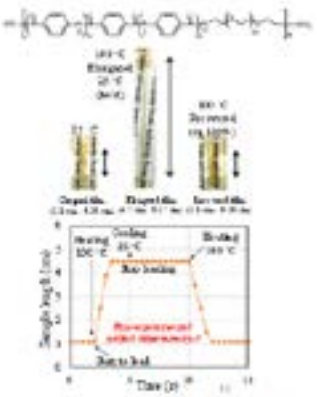

Figure 1. A novel SMP polymer based on PMBA, PEG and the SMP behavior.

Recent Publications

1. Shibasaki, Y.; Abe, Y.; Sato, N; Fujimori, A.; Oishi, Y. (2010), "Direct condensation polymerization of N-alkylated p-aminobenzoic acid and packing of rigid-rod main chains with flexible side chains.", *Polym. J.* 42, 72-80. 2) Fujimori, A.; Miura, S.; Kikkawa, Shibasaki, Y. (2014), "Fabrication and structure of "polymer nanosphere multilayered organization" *J. Polym. Sci. PART B: Polym. Phys.* 418, 338-349. 3) Miura, S., Shidara, Y., Yunoki, T., Shibasaki, Y., Fujimori, A. (2017), "High-Density Packing of Amorphous Polymer with Bulky Aromatic Rings in Interfacial Molecular Films", *Macromol. Chem. and Phys.* 218(7), 1600520. 4) Kotaki, T. Nishimura, N., Ozawa, M., Fujimori, A., Muraoka, H., Ogawa, S., Korenaga, T., Suzuki, E., Oishi, Y., Shibasaki, Y. (2016), "Synthesis of highly refractive and highly fluorescent rigid cyanuryl polyimines with polycyclic aromatic hydrocarbon pendants", Polymer Chemistry 7, 1297-1308. 5) Mori, T., Masukawa, S., Kikkawa, T., Fujimori, A., Satoh, A., Matsumoto, K., Jikei, M., Oishi, Y., Shibasaki, Y. (2017), "Rapid synthesis and properties of segmented block copolymers based on monodisperse aromatic poly(N-methyl benzamide) and poly(propylene oxide)" RSC Advances 7, 33812-33821.

Biography

Yuji Shibasaki is an Associate Professor in Polymer Chemistry at Iwate University, Japan. He studied Material Chemistry in Tokyo Institute of Technology (TIT) under the guidance of Professor Y Imai, and Polymer Chemistry at TIT under Professor T Endo. He received his PhD in 2000 for research of controlled ring-opening polymerization of lactones and cyclic carbonates. He worked as an Assistant Professor until 2007 in TIT. He engaged in Nanoparticle Chemistry in a Taton Research Group in the University of Minnesota (USA) from 2005 to 2006. His current research interests are in the synthesis of well-defined polymers, synthesis of bioinspired materials, and development of functional polymeric materials.

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