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1. Main Research Results

- 1) Development of practical synthesis of main chain-type polyrotaxane and polyrotaxane network
We have developed a practical synthetic protocol for crown ether-based main chain-type polyrotaxane by using polyaddition of ditopic isocyanate and alcohol. By using this protocol, we succeeded in the synthesis of high M_n of polyrotaxane with controlling the crown ether ratio. Additionally copolymerization and functionalized crown ether were also successfully produced the corresponding polyrotaxanes. Main chain-type polyrotaxane is an important scaffold to polyrotaxane network, the synthesized functionalized polyrotaxane was polymerized with various vinyl monomers to afford polyrotaxane networks.
- 2) Controlling of main chain-conformation by pH responsive switchable rotaxane side chain
In order to develop stimuli amplification molecular system, recently we developed pH responsive switchable rotaxane unit was introduced several conjugate polymers such as polyphenylacetylene, poly(m-diethynylbenzene), and so on. As the results, the reversible conformational transformation of main chain was achieved by pH stimuli. Although the response in rotaxane unit is only a few Å, a visible transformation of properties such as color and solubilities were reversibly switched.
- 3) Study on naphthalene containing polymer synthesis and optical properties
Design and synthesis of high performance polymer having naphthalene moiety with orthogonal benzoyl group were studied. The large free volume of the skeleton and high electron density of naphthalene unit are attributed to high refractive index polymer, and this time we evaluated the optical properties. As the results in some polymer showed high refractive indices despite of it was consisted of hydrocarbon.

2. List of Publication

Original Paper

- 1) High-Yield One-Pot Synthesis of Permethylated α -Cyclodextrin-based Polyrotaxane in Hydrocarbon Solvent through an Efficient Heterogeneous Reaction, Kazuko Nakazono, Tomoyuki Takashima, Takayuki Arai, Yasuhito Koyama, and Toshikazu Takata, *Macromolecules*, **2010**, *43*, 691-696.
- 2) Selective Transformation of a Crown Ether/*sec*-Ammonium Salt-Type Rotaxane to N-Alkylated Rotaxanes, Sakiko Suzuki, Kazuko Nakazono, and Toshikazu Takata, *Org. Lett.* **2010**, *12*, 712-715.
- 3) Synthesis of acetylene-functionalized [2]rotaxane monomers directed toward side chain-type polyrotaxanes, Kazuko Nakazono, Keiichiro Fukasawa, Takashi Sato, Yasuhito Koyama, and Toshikazu Takata, *Polym. J.*, *in press*.

Review

9,9-Diarylfluorene Moiety Incorporated into Polymer Main Chains: An Essential Skeleton Exhibiting Prominent Physical, Chemical, and Optical Properties, Yasuhito Koyama, Kazuko Nakazono, Hideki Hayashi, and Toshikazu Takata, *Chem. Lett.* **2010**, *39*, 2-9.

3. International Meeting

- 1) Young Scientist Symposium in KAIST, Daejeon, Korea Mar. 5-6, 2010, K. Nakazono, T. Ishino, T. Takashima, T. Takata, Main Chain-type Polyrotaxane: First Directed Synthesis. (Oral)
- 2) Advanced Polymeric Materials and Technology Symposium 2010, Jeju, Korea Jan 25-27, F. Ishiwari, K. Fukasawa, Y. Koyama, K. Nakazono, T. Takata, Polyacetylene Main Chain Conformation Controlled by Dynamic Structural Change of Pendent Rotaxane Wheels. (Poster)
- 3) 1st Federation of Asian Polymer Societies, Nagoya, Japan Oct 20 -23 2009F. Ishiwari, K. Fukasawa, Y. Koyama, K. Nakazono, T. Takata Polyacetylene Main Chain Conformation Controlled by Dynamic Structural Change of Pendent Rotaxane Wheels. (Oral)
- 4) 21st International Symposium on Chirality, Chirality 2009, Colorado, USA, Jul. 12-15, 2009, K. Nakazono, S. Suzuki, F. Ishiwari, T. Takata, Nitrogen Chiral Center Stabilized by Rotaxane Structure.(Poster)

4. Patent

1 application.

5. Others

Original paper 3: this paper was adopted as the journal cover picture.