1. Main Research Results

Creation of new devices and materials was achieved in the developments of novel polymers exploiting new cardo structure, novel rotaxane-containing materials and catalysts, and new polymer grafting tools, as follows:

1) Development of novel polymers for optical use

Design and synthesis of high performance polymers having heteroaromatics-containing cardo structure were studied, and novel optical use-oriented polymers with good mechanical properties as well as high refractive index and low birefringence were synthesized.

2) Development of rational helicity change system of polyacetylene linked to rotaxane shuttling system

The rational helicity change system was developed using through-space chirality transfer of pendant rotaxane equipped with (i) axial chirality or (ii) rotaxane chirality.

3) Development of novel rotaxane catalyst

It was revealed that the use of Pd-templated macrocycle catalyst allows the remarkable acceleration of polymer reaction via an intermediary formation of the pseudorotaxane, which is dependent on a high association constant and a proximity effect between the catalyst and the substrate originating from the topological structure of the catalyst.

4) Development of new rotaxane-containing polymers

New graft polymers and branched polymers with rotaxane structures at the connecting points of polymer were developed. It turned out that the change of polymer structure associated with the sliding movement of the connecting points strongly affects the macroscopic properties of the polymer.

5) Development of polymer nitrile N-oxide agent

One-pot synthesis of stable nitrile N-oxide-terminated polymer was developed, which enables catalyst- and solvent-free grafting reaction of unsaturated bond-containing polymers.

2. List of Publication

Original Paper


3) “Rational Design for Directed Helicity Change of Polyacetylene using Dynamic Rotaxane Mobility via Through-Space Chirality Transfer” Fumitaka Ishiwari, Kei-ichiro Fukasawa,


Review and Book


3. Invited/Plenary Talks in Conference

International Conference or Workshop


2) Nitrile N-Oxide: Heterocumulene Character and 1,3-Dipolar Function for Efficient Intra- and Intermolecular Catalyst-Free Click Reactions, 10th International Symposium on Functional π Systems (F\pi-10), Friendship Hotel, Beijing, China, 2011.10.13-17 (invited)

3) Unique Functions of Polymer Materials Possessing “Rotaxane Crosslinks” Providing High Chain Mobility at Crosslink Points:- Recyclability and Thermo-responsibility, Japan-Korea Joint Symposium 2011, Hokkaido Univ., Sapporo, Japan, 2011.10.30-11.03 (Plenary)

Domestic Conferences

Domestic Invited and Special Lectures: 9 Lectures

4. Patent

12 applications
5. Award
1) Toshikazu Takata, Prize for Chemical Technology, The Chemistry Society of Japan, 2011.5.25
2) Ayumi Kawasaki, Poster Award, Symposium Molecular-Chirality 2011, Molecular Chirality Research Organization, 2011.05.21
3) Sakiko Suzuki, Poster Award, Host-Guest Symposium, Host-Guest·Supramolecular Chemistry Organization, 2011.05.29
4) Yasuhito Koyama, 2nd BRIDGESTONE Soft Material Frontier Award (encouragement award), The Society of Rubber Industry, Japan, 2011.05.30
5) Yasuhito Koyama, Young Outstanding Presentation Award, Annual Meeting of The Society of Rubber Industry, Japan (2011), The Society of Rubber Industry, Japan, 2011.05.30
6) Keumhee Jang, Young Outstanding Presentation Award, Annual Meeting of The Society of Rubber Industry, Japan (2011), The Society of Rubber Industry, Japan, 2011.05.30
7) Fumitaka Ishiwari, International Symposium on Functional p-Electron Systems Poster Award, Chinese Academy of Sciences, 2011.10.17
8) Yosuke Akae, Poster Award, 1st CSJ Chemical Festa, The Chemistry Society Japan, 2011.11.15
9) Daisuke Aoki, Poster Award, 1st CSJ Chemical Festa, The Chemistry Society Japan, 2011.11.15

6. Others
1) Paper introduced by Chemistry World Magazine, 15 September 2011
Graft Polyrotaxane: A New Class of Graft Copolymers with Mobile Graft Chains
2) Paper introduced by NPG Asia Materials, 19 July 2011
Size-complementary Rotaxane Cross-link for Stabilization and Degradation of Supramolecular Network
3) Paper selected as a Highly Important Paper, Polymer Journal, 11 November 2011
Synthesis and Properties of Polyrotaxane Network Prepared from Pd-Templated Bis-macrocycle as a Topological Cross-Linker
4) Paper introduced by Society of Plastics Engineers, 14 November 2011
Synthesis and Properties of Polyrotaxane Network Prepared from Pd-Templated Bis-macrocycle as a Topological Cross-Linker

5) Paper selected as a Back Cover, Macromol. Rapid Commun. 15 November 2011
A Novel Polymeric Chemosensor: Dual Colorimetric Detection of Metal Ions Through Click Synthesis