論文 / 著書情報
Article / Book Information

題目(和文)	高分子[2]ロタキサンを用いるポリロタキサンの軸成分の性質に及ぼす輪成分の運動性の効果
Title(English)	Effect of Component Mobility on Property of Axle Component of Polyrotaxane Using Macromolecular [2]Rotaxane
著者(和文)	陳震
Author(English)	Zhen Chen
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第10125号, 授与年月日:2016年3月26日, 学位の種別:課程博士, 審査員:高田 十志和,柿本 雅明,石曽根 隆,手塚 育志,中嶋 健
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第10125号, Conferred date:2016/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	要約
Type(English)	Outline

論文の要約

所属：理工学研究科　有機・高分子物質専攻
氏名：陳震（CHEN ZHEN）　学籍番号：13D07148

論文題目：Effect of Component Mobility on Property of Axle Component of Polyrotaxane Using Macromolecular [2]Rotaxane
高分子[2]ロタキサンを用いるポリロタキサンの軸成分の性質に及ぼす輪成分の運動性の効果

The title of this thesis is “Effect of Component Mobility on Property of Axle Component of Polyrotaxane Using Macromolecular [2]Rotaxane” which consists of 6 chapters.

In chapter 1 “Introduction”, the general background of rotaxane switch and effect of wheel components on the property of polyrotaxane were described to clarify the purpose of this thesis.

In chapter 2 “Synthesis of Macromolecular [2]Rotaxanes with Different Degree of Polymerization and Their Component Mobility-Dependent Property”, the macromolecular [2]rotaxanes (M2Rs) consisting of poly (*δ*-valerolactone) having different degree of polymerization, and two series of threaded crown ethers which were on the axle polymer fixed at the end of polymer chain and movable on the axle polymer, were successfully synthesized. The crystallinity of the axle polymer depending on the component moblity showed the presence of a critical point where the phase transition from crystalline to amorphous was induced by the wheel’s movement when the axle polymer has a certain length.

In chapter 3 “Synthesis and Characterization of Macromolecular [2]Rotaxane Having Size-Different Substituents”, the reason why the wheel component mobility affected the crystallization behavior of M2R was investigated. Crystallization behavior of M2R whose wheel component was fixed in the center of the polymer axle indicated that the phase transition was likely to result from the bulkiness effect of the wheel component. In order to reveal the bulkiness effect of the wheel component on the axle crystallinity, the crystallinity of the M2Rs having the movable wheel components was studied and compared with those of the M2Rs with the fixed wheel components. It was concluded that the properties of the axle polymers clearly depend on both the mobility and the bulkiness of the wheel components.

From the results of chapter 2 and 3, the mobility of the component and the length of the polymer axle affect the crystallization of the M2R. Moreover, bulkiness of the wheel component hinders the crystallization of M2R.

In chapter 4 “Synthesis and Characterization of Block Copolymer Consisting of Phase Transitionable Macromolecular [2]Rotaxane”, the synthesis of block copolymer consisting of phase transitionable M2R moiety was described. The block copolymer consisting of phase transitionable M2R moiety was synthesized by the living ring-opening polymerization of 1,5-dioxepan-2-one initiated at the end of polymer chain of the phase transitionable M2R. The crystallization behavior of the resulting block copolymers indicated that the phase transition induced by the microscopic wheel mobility affected the macroscopic whole polymer property of the block copolymer.

In chapter 5 “Synthesis and Characterization of Rotaxane-Linked Block Copolymer Having Transitionable Axle Polymer Chain”, the preparation of rotaxane-linked block copolymer having phase transitionable M2R was described. The phase transitionable M2R macroinitiator having a trithiocarbonate introduced onto the wheel component was firstly synthesized. The resulting macroinitiator was subjected to the RAFT polymerization of *n*-butyl acrylate, affording the block copolymer comprising M2R as a crystalline domain and poly(*n*-butyl acrylate) as an amorphous domain. The *N*-acetylation of the *sec*-ammonium moiety of M2R triggered the phase transition of M2R from crystalline to amorphous induced by mobility change of the threaded crown ether, leading to macroscopic property change. Furthermore, the result of the viscosity measurement suggested that the movable wheel component also led to the low viscosty of the rotaxane-linked block copolymer.

In Chapter 6 “Conclusion”, the results are summarized. The future prospect of use of the phase transitionable M2R and its applications also are of their work stated.

As stated above, this thesis demonstrates the effect of the component mobility on the property of the axle component in polyrotaxane, which is achieved with the structure-definite polyrotaxanes M2Rs consisting of one wheel component and one polymer axle component. The fundamental discovery of the phase transition of M2R with a certain axle length is also applied to block copolymer system.