

Title **Macromolecular Engineering by Atom Transfer Radical Polymerization**

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Date & Time Thursday, January 9, 2014 5:00 p.m.

Place I²CNER Hall, Ito campus, Kyushu University

Abstract Macromolecular engineering is based on precise design, synthesis, processing and characterization of targeted materials for specific applications. Many advanced nanostructured functional materials were recently designed and prepared by controlled/ living radical polymerization such as Atom Transfer Radical Polymerization (ATRP). More than 100 million tons of polymers are produced annually world-wide by conventional radical polymerization (i.e., ~ 20 kg per capita!). However, macromolecular engineering is impossible in this process, because radicals are very reactive intermediates and their lifetime is less than a second. In order to temper this uncontrolled radical behavior, we introduced a new concept of extending life of propagating chains from ca. 1 second to more than 1 day, by inserting a dormant period of ~ 1 minute after each ~ 1 ms activity. Thus, the 1 second of radical activity is extended to several hours with thousands intermediate dormancy periods.

ATRP of acrylates, methacrylates, styrenes, acrylamides, acrylonitrile and other vinyl monomers was employed for macromolecular engineering of polymers with precisely controlled molecular weights, low dispersities, designed shape, composition and functionality. Examples of block, graft, star, hyperbranched, gradient and periodic copolymers, molecular brushes and various hybrid materials and bioconjugates prepared with high precision will be presented. These polymers can be used as components of various advanced materials such as health and beauty products, biomedical and electronic materials, coatings, elastomers, adhesives, surfactants, dispersants, lubricants, additives, or sealants and also as precursors to nanostructured N-doped carbons with special catalytic activity.

About the Speaker

Education:

1969-1972 Technical University of Moscow, B.S./M.S.,
1972-1976 Polish Academy of Sciences, Ph.D., (Prof. S. Penczek, Thesis Advisor)
1976-1985 Polytechnic University of Lodz, Poland, Habilitation

Professional Career:

1985-present Assistant, Associate and currently J.C. Warner University Professor of Natural Sciences Professor, Carnegie Mellon University

Awards:

2011 Wolf Prize in Chemistry

Research Interests:

1. Synthesis of well -defined macromolecules via living and controlled polymerizations. Radical, cationic, and anionic polymerization of alkenes and heterocyclics. Block, graft and gradient copolymers. Control of chain microstructure and topology. Functional polymers and telechelics; 2. Catalysis. Homogeneous and heterogeneous catalysis; 3. Preparation of well-defined polymers and hybrids for optoelectronic, biomedical and other special applications.

Host: Professor Atsushi Takahara

Co-hosted: JST ERATO Takahara Soft Interfaces Project

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