Precision Synthesis of Multiple Controlled Polymers via Radical Polymerization

Masami Kamigaito
(Nagoya University, Graduate School of Engineering, Professor)

【Outline of survey】

Natural macromolecules such as DNA and proteins possess highly controlled primary structures in terms of chain length, stereochemistry, and monomer sequence, which lead to precisely controlled higher order structures and then result in their excellent functions. In contrast, synthetic polymers, such as plastics, rubbers, fibers, etc., are mostly prepared by radical polymerizations, which are considered unsuitable for the construction of functional materials due to the inherent difficulty in control of the polymerizations. This project is thus directed to the development of radical polymerizations that can control the molecular weights, steric structures, and monomer sequences. More specifically, this study focuses on the precise control of molecular weights and tacticities by designing the catalytic systems for living radical polymerizations as well as the construction of new radical polyadditions by designing the monomers with built-in sequences. Further combination of these controlled radical polymerizations can result in multiple controlled polymers that have not been synthesized.

【Expected results】

The expected results would be highly valuable from both scientific and industrial viewpoints because this research aims one of the ultimate goals in polymer synthesis; i.e., multiple control of molecular weight, stereochemistry, and sequence in radical polymerizations. Especially, this new radical polyaddition can permit the synthesis of a series of sequence-regulated polymer libraries based on the C-C bond formation reactions for the main chain. Furthermore, a sequence-controlled introduction of functional groups will possibly lead to new functional polymers with well-defined higher order structures.

【References】

• Metal-Catalyzed Radical Polyaddition as a Novel Polymer Synthetic Route, K. Satoh, M. Mizutani, M. Kamigaito, *Chem. Commun.*, 1260-1262 (2007).
• Metal-Catalyzed Living Radical Polymerization, M. Kamigaito, T. Ando, M. Sawamoto, *Chem. Rev.*, 101, 3689-3745 (2001).

【Term of project】 FY2007－2011	【Budget allocation】20,600,000 yen (2007 direct cost)

【Homepage address】 http://chiral.apchem.nagoya-u.ac.jp/~living/index.html