Macromolecular Engineering by Taming Free Radicals

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Many advanced nanostructured functional materials were recently designed and prepared by controlled/ living radical polymerization (CRP). More than 100 million tons of polymers are produced annually world-wide by conventional radical polymerization. However, macromolecular engineering is impossible in this process. Copper-based ATRP (atom transfer radical polymerization) catalytic systems with polydentate nitrogen ligands are among most efficient controlled/living radical polymerization systems. Recently, by applying new initiating/catalytic systems, Cu level in ATRP was reduced to a few ppm. 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. Special emphasis will be on nanostructured multifunctional hybrid materials for application related to environment, energy and catalysis.

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Author Biography: Krzysztof Matyjaszewski is J.C. Warner University Professor of Natural Sciences at Carnegie Mellon University. His current group at CMU includes 14 graduate students and 10 postdoctoral fellows. He discovered Cu-mediated atom transfer radical polymerization, commercialized in 2004 in US, Japan and Europe. He has co-authored > 20 books and >1,000 publications (cited >136,000 times, h-index 177, Google Scholar) and holds 61 US patents. He received 10 honorary degrees and is a member of National Academy of Engineering, Polish Academy of Sciences, Russian Academy of Sciences, and National Academy of Inventors.

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