

Combination of Cationic and RAFT Polymerizations for Macromolecular Engineering

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Abstract. Macromolecular engineering is the technology of total synthesis of highly controlled macromolecules, to achieve control over their physical properties, including molecular weight, dispersity, end-functionality, etc. Some monomers like isobutylene (IB) can solely be polymerized by cationic polymerization; whereas, (meth)acrylate-based monomers can only be polymerized by anionic or radical polymerizations.¹ The key limitation for the synthesis of macromolecular blocks was to polymerize two or more different types of monomers with dissimilar reactivity profiles. To overcome this limitation, the combination of two different polymerization techniques has gained importance. Polyisobutylene (PIB) is a saturated biostable and biocompatible polymer of isobutylene (IB), having exceptional properties such as good thermal stability, chemical inertness, superior mechanical properties, and low gas permeability. PIB-based amphiphilic block copolymers have been reported to show thermo-responsive self-aggregation behaviour.² Again, pH-responsive PIB-based block copolymers have demonstrated helical or core-shell type micellar structures.³ They also formed pH-responsive self-healing polymeric gels.⁴ Multi-responsive PIB-based polymers may be prepared for site-targeted delivery. Block copolymers containing PIB have been used for the preparation of crystalline polymers⁵ and their amorphous nature can be used to modulate crystallinity. We are presently working on biocompatible PIB-based block copolymers for application in ion transport, insulin fibril inhibition,⁶ etc. The present discussion will focus recent developments and applications of various macromolecular architectures via combined living cationic and RAFT polymerizations (Figure 1).

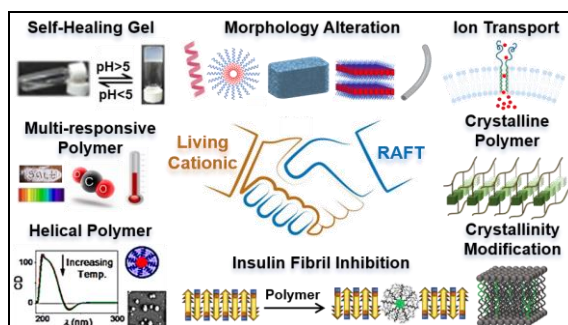


Figure 1. Applications of polymers synthesized by combination of cationic and RAFT polymerization.

References

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