Styrene butadiene rubber (SBR) prepared by *ab initio* emulsion polymerization using macro-RAFT agent

Dongjun Lee, Hyun-jong Paik*,

Department of Polymer Science and Engineering, Pusan National University, Busan, 46241, Korea (*hpaik@pusan.ac.kr)

Abstract

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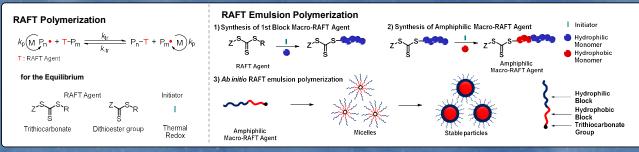
Emulsion styrene butadiene rubber (ESBR) is widely used in tire manufacturing due to its excellent physical properties and environmentally friendly water-based synthesis process. However, its free-radical mechanism leads to side reactions such as coupling and disproportionation, which terminate chain growth and complicate molecular weight distribution (MWD) control. The resulting broad MWD increases energy loss and negatively affects mechanical and viscoelastic properties.

In this study, we report the first successful synthesis of SBR via ab initio reversible addition-fragmentation chain transfer (RAFT) emulsion polymerization using poly(acrylic

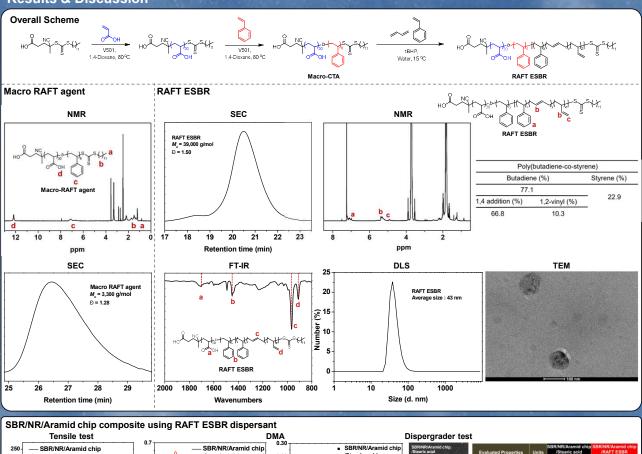
In this study, we report the first successful synthesis of SBR via ab Infilo reversible addition-fragmentation chain transfer (KAFT) emulsion polymerization using poly(acrylic acid-b-styrene) with a trithiocarbonate end group as a reactive surfactant. By employing RAFT polymerization, we successfully synthesized ESBR with a narrow MWD. The polymerization was confirmed using FT-IR and NMR spectroscopy, while particle size was analyzed using dynamic light scattering (DLS).

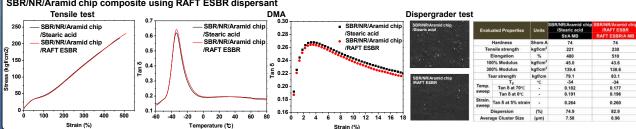
Furthermore, we fabricated a SBR, natural rubber (NR), and aramid chip composite using RAFT ESBR as a dispersant for the aramid chip. The acrylic acid (AA) block at the polymer chain end facilitates hydrogen bonding with the aramid surface, while the butadiene units in the SBR segment participate in the vulcanization reaction with the base rubber. This molecular design improves both the dispersion of aramid chip within the rubber matrix and the mechanical properties of the resulting composite.

Introduction



Results & Discussion





Conclusion

- ✓ We designed a macro-RAFT agent, PAA-b-PS, which functions both as a steric stabilizer and a chain transfer agent in RAFT emulsion polymerization. Using this macro-RAFT agent, RAFT ESBR was synthesized via ab initio RAFT emulsion polymerization, achieving a narrow molecular weight distribution (MWD).
 ✓ An RAFT ESBR dispersant was applied to the fabrication of aramid chip reinforced rubber composites. The dispersant enhanced aramid chip dispersion and interfacial
- An RAFT ESBR dispersant was applied to the fabrication of aramid chip reinforced rubber composites. The dispersant enhanced aramid chip dispersion and interfacial adhesion with the rubber matrix. As a result, the composite exhibited improved mechanical properties (tensile strength, elongation, tear resistance) and viscoelastic performance (Tan 8 at 70 °C and 0 °C).

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Nano Material Synthesis Lab, Polymer Science & Engineering, Pusan National University, Korea