NU Tech
Technology Partnership of Nagoya University, Inc.

(E-13)

Novel Thermoplastic Elastomers for Manufacturing

Background

Cross-linked melt polymers at ambient temperature do not flow due to their network structures, but show softness and stretchability; these materials are called elastomers. Elastomers are used in various applications, the most familiar of which are rubber bands and vehicle tires. However, conventional elastomers with chemically cross-linked covalent bonds cannot be reprocessed due to its limited dynamic properties.

Technology Overview

Nagoya University researchers have succeeded in developing supramolecular elastomers by pseudo-cross-linking with noncovalent bond intersections (such as hydrogen bonding) via identifying the best mechanical properties of thermoplastic elastomers. Block copolymer-based supramolecular elastomers are usually composed of glassy block A and melt hydrogen-bonded block B, both of which are connected to one another by covalent bonds. For high performance soft polymer materials, in this invention ABA triblock copolymers with noncovalent bonds (hydrogen-bonded amide groups (P-Ba-P)) have been designed, and it shows much better elongation properties than conventional thermoplastic elastomers, with improved maximum stress and toughness. By introducing noncovalent bonds (self-complementary hydrogen-bonding) into the molten B middle block of ABA triblock copolymers, the toughness and the elongation at break have been increased.

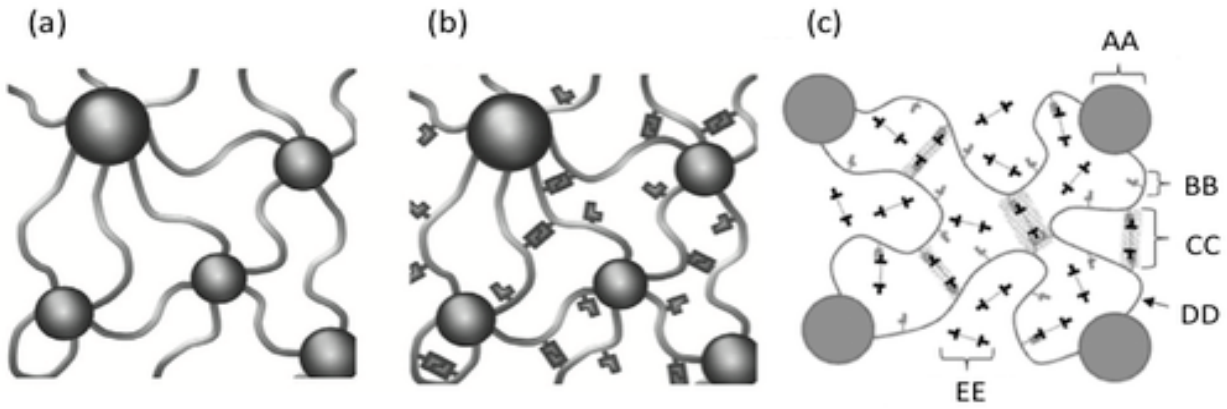

Figure1.Schematic illustrations of (a) a polymer network of conventional ABA triblock copolymers, (b) a supramolecular polymer network of ABA triblock copolymers with hydrogen bonding functional groups in melt B middle blocks and (c) Non-covalent bonding soft elastomer; (AA) Vitreous chain-A domain, (BB) Functional group capable of non-covalent bounding with solvent, (CC) Supramolecular crosslinking, (DD) Chain B, (EE) Solvent capable of non-covalent bonding with functional group of chain B.

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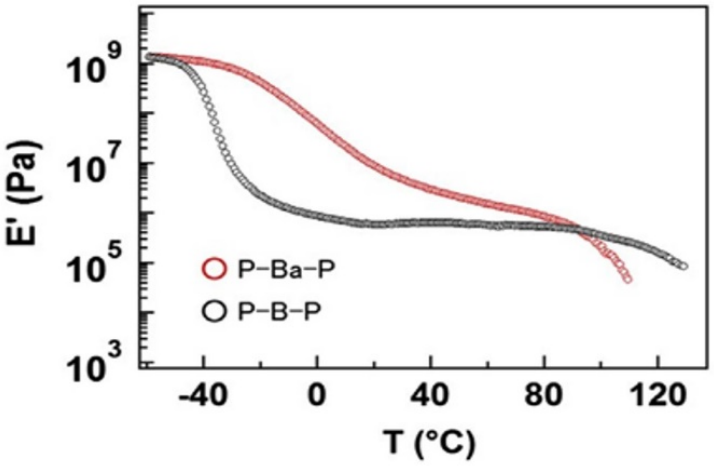

Figure 2. Storage modulus vs. temperature. Triangle symbol rep- resents P-B-P whereas circle symbol represents P-Ba-P.

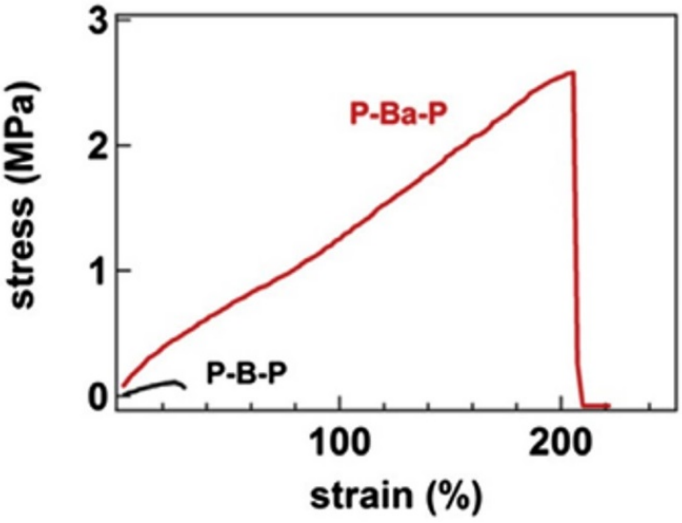

Figure 3. Stress-strain curves of P-B-P and P-Ba-P. Dotted and sol- id lines represent P-B-P and P-Ba-P, respectively.

Seeking
Licensing

IP Status
Patent application submitted

Patents
PCT/JP2016/063152 has been filed

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