



# Block Copolymer Toughener for Isotactic Polypropylene

Technology No. 20180226

**IP Status:** Pending US Patent; **Application #:** 16/378,970

## New copolymer based Impact Modifier for isotactic polypropylene (iPP)

Isotactic polypropylene is the most common form of polypropylene. It is used in many large volume applications such as fibers and automotive. This new technology toughens isotactic polypropylene (iPP) by blending low concentrations of poly(ethylene-alt-propylene)-b-poly(ethylene-ran-ethyl ethylene) (PEP-PEEE) diblock copolymers in iPP. The copolymer toughening agents are hydrogenated isoprene/butadiene copolymers which spontaneously form uniformly dispersed nano-size rubber micelles. This additive at low concentrations provides improved tensile and impact properties while maintaining high strength. This technology could offer a new toughening agent for commercial iPP applications that require high impact strength.

### MN-IP Try and Buy

#### Try

- Trial period is up to 6 months
- Trial fee is \$5,000 for six months
- Trial fee is waived for MN companies or if sponsoring \$50,000+ research with the University
- No US patent expenses during trial period

## **Buy**

- \$25,000 conversion fee (TRY to BUY)
- Royalty rate of 3% (2% for MN company)
- Royalty free for first \$1M in sales

## **Equivalent toughness with low loadings preserves high clarity and strength**

Isotactic polypropylene (iPP) is intrinsically brittle under fast load or at low temperatures, limiting its use as a high-performance engineering plastic. Past attempts to improve toughness through compounding or blending with rubber have been most effective at high rubber content (>20 wt%) which significantly reduces the modulus and strength of the iPP. This new technology overcomes the undesirable properties when rubber additives are used while imparting toughness. By simply melt-blending this new toughening agents with iPP, impact and toughness of the blend dramatically improve. Because the block copolymers are rubbery in nature and designed to disperse during blending, increased toughness can be achieved with low loadings (5-10% wt%), preserving high clarity and strength. These blends increased Izod impact strength of iPP at least 5 times greater than that of other toughening agents and tensile strain at break by at least 20 times compared to other toughening agents.

### **BENEFITS AND FEATURES:**

- Efficiently toughens isotactic PP
- Compatible in standard melt-blending operations as an additive
- Creates a new market for novel iPP additives using isoprene and butadiene monomers
- Imparts desirable mechanical (tensile and impact) properties at very low loadings
- Matches high strength of pure iPP while imparting toughness
- Izod impact strength at least 5 times greater than iPP
- Tensile strain at break at least 20 times greater than iPP

### **APPLICATIONS:**

- Commercial iPP products requiring impact strength and toughness
- Additive for toughening isotactic polypropylene (iPP)

**Phase of Development** - Prototype developed

**Researchers**

Frank Bates, ScD

*Professor, Chemical Engineering and Materials Science*

[External Link](http://www.cems.umn.edu) (www.cems.umn.edu)

**Publications**

[\*Block Copolymer Micelle Toughened Isotactic Polypropylene\*](#)

*Macromolecules*, 2017, 50 (17), pp 6421-6432

**Interested in Licensing?**

The University relies on industry partners to scale up technologies to large enough production capacity for commercial purposes. The license is available for this technology and would be for the sale, manufacture or use of products claimed by the issued patents. Please contact us to share your business needs and technical interest in this technology and if you are interested in licensing the technology for further research and development.

<https://license.umn.edu/product/block-copolymer-toughener-for-isotactic-polypropylene>