Threading-The-Needle: Compatibilization of HDPE/ iPP Blends with Butadiene-Derived Polyolefin Block Copolymers | January, 2023

The Center for Sustainable Polymers (CSP) connects scientists from the University of Minnesota, Cornell University, Clark Atlanta University, Northwestern University, the University of California, Berkeley, the University of Chicago, and the University of South Dakota in a manner that promotes highly collaborative research. This environment allows partnership across various scientific disciplines, including polymer, organic, biological, inorganic, and theoretical chemistry. As such, CSP researchers have been able to approach challenging problems related to sustainability with a wide range of expertise.

Polyethylene (PE) and isotactic polypropylene (iPP) account for more than half of all synthetic polymers produced worldwide today. These nearly indestructible plastics are difficult to separate in waste streams, yet if mixed during melt recycling the blended materials are brittle and useless due to the presence of mechanically weak interfaces in the phase separated products. Anionic polymerization of butadiene into a mixed microstructure triblock copolymer followed by catalytic hydrogenation leads to EXE, where E denotes poly(ethylene), and X represents a strategically designed statistical copolymer of ethylene and ethylethylene that is melt miscible with iPP. This EXE triblock copolymer migrates to the interface between phase separated PE and iPP when melt-mixed at a concentration of just 1 wt%. The resulting compatibilized blends, either PE or iPP continuous, exhibit mechanical toughness comparable to the pure components, with greater than 500% strain at break. This represents a commercially viable approach to recycling PE and iPP.

Shen, L.; Gorbea, G. D.; Danielson, E.; Cui, S.; Ellison, C. J.; Bates, F. S. Threading-The-Needle: Compatibilization of HDPE/ I PP Blends with Butadiene-Derived Polyolefin Block Copolymers. *Proc. Natl. Acad. Sci.* U.S.A. **2023**, *120* (34) [DOI:10.1073/pnas.2301352120]