Combining the Most Used Plastics with Multiblock Polymers (Feb 2017)

The Center for Sustainable Polymers (CSP) connects scientists from the University of Minnesota, Cornell University, Northwestern University, and the University of California, Berkeley in a manner that promotes highly collaborative research. This environment allows partnership across various scientific disciplines, including polymer, organic, 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) are the two most abundant plastics worldwide and account for about two-thirds of all plastic production. Despite the similar hydrocarbon makeup, these polymers phase separate, which erodes the mechanical properties of melt blends and creates challenges for recycling the materials. Given the abundance, utility, and environmental impact of PE and iPP there is a compelling need to improve the recyclability and associated mechanical properties of these repurposed materials. A CSP research team of synthetic chemists, and chemical and materials engineers discovered that as little as 1% by weight of a newly created PE/iPP multiblock polymer could combine commercial PE and iPP into remarkably tough composite blends. Postdoctoral scholar Dr. James Eagan, along with Dr. Rocco Di Girolamo and CSP senior investigators Dr. Anne LaPointe and Prof. Geoff Coates utilized their experience in olefin polymerization to synthesize well-defined multiblock copolymers of PE and iPP. Working with graduate students Jun Xu and Christopher Thurber, and Professors Christopher Macosko and Frank Bates, also CSP senior investigators, the Cornell-Minnesota collaborative team studied combinations of various types of multiblock polymers as additives and discovered a new mechanism of polyolefin blend compatibilization, resulting in unprecedented mechanical integrity in otherwise brittle blends of these top two plastics.

These findings have been published in the journal Science; the collaborative nature and industrial interest in the Center for Sustainable Polymers will allow for applying these materials in industrial recycling.