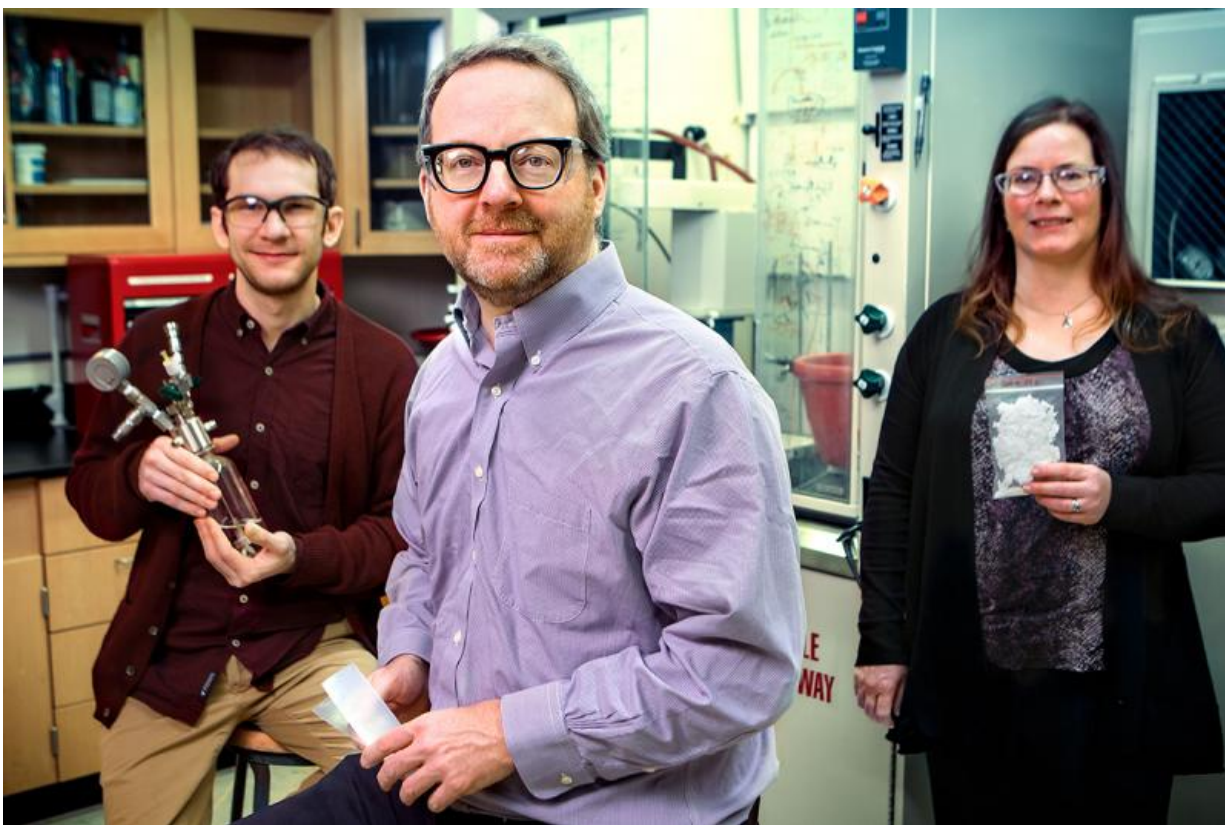


# Polymer additive could revolutionize plastics recycling

February 24 2017, by Tom Fleischman

---



Geoffrey Coates, center, in his lab with James Eagan, a postdoctoral researcher in Coates' group and researcher Anne LaPointe. Credit: Robert Barker/University Photography

When Geoffrey Coates, the Tisch University Professor of Chemistry and

Chemical Biology, gives a talk about plastics and recycling, he usually opens with this question: What percentage of the 78 million tons of plastic used annually for packaging – for example, a 2-liter bottle or a take-out food container – actually gets recycled and reused in a similar way?

The answer, according to the Ellen MacArthur Foundation, is just 2 percent. Sadly, nearly a third is leaked into the environment, around 14 percent is used in incineration and/or energy recovery, and a whopping 40 percent winds up in landfills.

One of the problems: Polyethylene (PE) and polypropylene (PP), which account for two-thirds of the world's plastics, have different chemical structures and thus cannot be repurposed together. Or, at least, an efficient technology to meld these two materials into one hasn't been available in the 60 years they've both been on the market.

That could change with a discovery out of Coates' lab. He and his group have collaborated with a group from the University of Minnesota to develop a multiblock [polymer](#) that, when added in small measure to a mix of the two otherwise incompatible materials, create a new and mechanically tough polymer.

Their work is detailed in a paper, "Combining polyethylene and polypropylene: Enhanced performance with PE/iPP multiblock polymers," published online Feb. 23 in *Science*.

James Eagan, a postdoctoral researcher in Coates' group, is lead author of the paper. Other collaborators included researcher Anne LaPointe and former visiting scientist Rocco DiGirolamo.

Scientists for years have tried to develop a polymer that does what Coates, LaPointe and Eagan have achieved. By adding a miniscule

amount of their tetrablock (four-block) polymer – with alternating polyethylene and polypropylene segments – the resultant material has strength superior to diblock (two-block) polymers they tested.

In their test, two strips of plastic were welded together using different multi-block polymers as adhesives, then mechanically pulled apart. While the welds made with diblock polymers failed relatively quickly, the weld made of the group's tetrablock additive held so well that the plastic strips broke instead.

"People have done things like this before," Coates said, "but they'll typically put 10 percent of a soft material, so you don't get the nice plastic properties, you get something that's not quite as good as the original material."

"What's exciting about this," he said, "is we can go to as low as 1 percent of our additive, and you get a plastic alloy that really has super-great properties."

Not only does this tetrablock polymer show promise for improving recycling, Eagan said, it could spawn a whole new class of mechanically tough polymer blends.

"If you could make a milk jug with 30 percent less material because it's mechanically better, think of the sustainability of that," he said. "You're using less [plastic](#), less oil, you have less stuff to recycle, you have a lighter product that uses less fossil fuel to move it."

Coates is co-founder of Novomer, which uses Cornell-developed catalyst technologies to produce high-performance, cost-effective and environmentally responsible polymers and chemicals.

**More information:** James M. Eagan et al. Combining polyethylene

and polypropylene: Enhanced performance with PE/PP multiblock polymers, *Science* (2017). [DOI: 10.1126/science.aah5744](https://doi.org/10.1126/science.aah5744)

Provided by Cornell University

Citation: Polymer additive could revolutionize plastics recycling (2017, February 24) retrieved 24 April 2024 from

<https://phys.org/news/2017-02-polymer-additive-revolutionize-plastics-recycling.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.