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Originally Published [MPMN](#) March 2008

## BREAKTHROUGHS

### Supplier Turns Pollutants into Plastic

[Stephanie Steward](#)

Green manufacturing trends have driven engineers to take seemingly far-fetched notions of making plastic out of any crop or waste material and turn those ideas into practical realities. Novomer Inc. is one such company, customizing performance characteristics of its ecofriendly plastics, which are made with waste products like carbon dioxide.

Developed by Geoffrey Coates, the company's cofounder and chief scientific officer, along with his research group at Cornell University, the plastics-making process uses catalysts to create polymers whose source materials contain 30 to 50 % carbon monoxide and carbon dioxide. This technology can significantly reduce the amount of petroleum products and fossil fuels typically required for manufacturing polymers, according to Novomer president Charles Hamilton.

Novomer bonds liquid epoxies with carbon dioxide in a reactor similar to a pressure cooker with the help of a catalyst, such as beta-diiminate zinc acetate. The catalyst material is then filtered out of the honey-like liquid after it is removed from the reactor. Because the process is based on synthetic chemistry, Novomer has a great amount of control and flexibility in manufacturing the materials.

"The ability to use synthetic chemistry to make these materials allows us to provide very high quality control and custom performance characteristics—such as heat resistance and time to reabsorption," says Hamilton. "Device makers can work together with Novomer to specify precise performance characteristics for medical polymers. We're not limited by the narrow window of customization that biologically derived polymers are limited to."

Making polymers based on biological materials has been possible for some time; however, the concept was considered somewhat of a novelty because the high manufacturing cost discouraged large-scale production, according to the company. Its process not only reduces that cost, but also gives the firm more control over the composition of the materials

"We have the option of making biodegradable materials or more-enduring materials, depending on the need," says Hamilton. "We can make a variety of high-performing bioabsorbable custom materials, such as high-melt-point PLA, high-performance PHA, and bioreabsorbable polymers, from carbon dioxide," he says. The green materials can be made to deliver drugs slowly over time or for bioreabsorbable applications, like implants, stents, or orthopedic devices.

"There are many players, large and small, working on new green polymers," says Hamilton. "What sets Novomer apart is our ability to very precisely control simple building blocks like carbon dioxide and epoxies using catalytic chemistry to make high-performance materials."

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A carbon dioxide-based polymer (pictured above in resin form) has the consistency and viscosity of honey.