PLASTIC RECYCLING PIONEER

Mike Biddle tours MBA Polymers' storage area, which holds scrap durable plastics ready to enter the plant's sorting process. "If it has engineering plastics in it and if there's a steady stream of it, we're interested in it," he says. However, the company does work with suppliers to develop specifications for materials it accepts.

Meet MBA Polymers Inc., which has developed a high-tech process to recycle engineering-grade plastics.

Before and After: Jim McGettrick, sales manager, and Trip Allen, cofounder and vice president, hold plastic items bound for recycling. In the background are supersacks that can each hold 2,000 pounds of market-ready recyclate.

By Aaron B. Pryor

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These days, recycling plastics such as PET and HDPE is a piece of cake. Between hand sorting and automated sorting technology, it's easy to separate old soda bottles from milk jugs from polystyrene food containers, and so on.

It's not so easy, though, to do the same with engineered thermoplastics—those used in durable products such as automobiles, computers, telephones, refrigerators, ski boots, household appliances, and scads more gadgets. Durable plastic goods often contain mixtures of many different types of polymers and can be imbedded with metal parts and other contaminants. Such problems have heretofore made reclaiming these plastics difficult to impossible.

Enter MBA Polymers Inc., a trailblazer in developing technology to effectively and economically sort engineering-grade plastics. This is its story.

Pursuing Plastics

When writing about MBA Polymers, reporters can't resist the temptation to refer to the famous scene in the movie "The Graduate" in which a family friend urges the protagonist, young Benjamin Braddock, to consider a career in plastics.

Samples of sorted plastics are displayed in MBA Polymers' conference room. About the firm's rather secretive sorting process, Mike Biddle says, "All I can tell you is that we can take mixed plastics and turn them into separated plastics. We use a lot of different techniques to separate the plastics. We don't even tell our investors exactly how we do it."

Mike Biddle, president of MBA Polymers, is the man they often compare to, or contrast with, Braddock.

Perhaps the main difference between the two is that Biddle took that advice.

After earning a bachelor's degree in chemical engineering, he began his career in plastics by working for General Electric Co. for three years, mostly in its plastics lab and applications center. In 1981, he joined Cummins Engine Co., developing polymer applications for diesel engines. After receiving his Ph.D. in 1987, he joined Dow Chemical, where he focused on recycling and applications development for plastics. In 1993, following a one-year leave in 1990 to complete a Sloan Fellowship at Stanford University, he left Dow to found his own consulting firm, Michael Biddle & Associates.

In 1994, Biddle expanded beyond consulting by establishing MBA Polymers, a plastics research and development company, with vice president and cofounder Trip Allen. Funding came from grants and research projects sponsored by the automotive, electronics, electrical, and other industries as well as government entities such as the Department of Energy, Department of Commerce, EPA, and BARTA, a California state-administrating agency. Much support came from the American Plastics Council (APC) (Washington, D.C.).

As Biddle explains, "Metals have been recycled for a long time. But the plastic content in cars has gone up, so recyclers have had less metal to sell. That's much of the reason why there's a lot of interest in what we're doing and one reason we're getting so much support."

In 1995, support from APC helped launched MBA Polymers on its current path. It was then that the two groups joined forces to create a new research center whose goal would be "to develop and demonstrate the most advanced durable plastics recycling technology in the United States"—if not the world.

The facility was initially to be a pilot research operation sited in Berkeley, Calif., in a 10,000-square-foot plant. Berkeley had been planning a "green belt," an industrial park dedicated to industries with an environmental focus. MBA Polymers was to serve as one of the park's anchors.

Unfortunately, adequate space wasn't available in Berkeley. So in 1996, the company moved about 10 miles northwest to Richmond, Calif., into the 90,000-square-foot facility in which it resides today.

A High-Tech Process

MBA Polymers operates in a beige, common-looking building in an industrial park. Like many industrial operations, it has loading docks and a fence surrounding its outdoor storage area, which is full of bales and boxes of flaked plastics and durable plastic parts.

Despite this common exterior, the activity inside is anything but commonplace.

Inside, MBA Polymers operates what could be the nation's most advanced system for identifying and sorting engineered thermoplastics. That's a steep challenge because of the variety of possible polymers involved, the coatings and additives on them, not to mention contaminants such as metal and other nonplastic parts. The firm's sorting challenge is even steeper given that it handles not only clean postindustrial durable plastics, but also postconsumer material, with all the additional contaminants that can come with them. "Every material you can possibly imagine is fed through here," says Biddle.

All of this plastic is destined for a run through MBA Polymers' multistage processing and sorting system. Biddle sums up this highly sophisticated process this way: "We just grind it all up and let our process do the work."

The first step in the process is size reduction—that is, shredding—of the scrap

The emphasis at MBA Polymers is on automation. Here, unprocessed material makes its way up a conveyor toward the initial size-reduction stage.

plastics. The material heads up an escalator conveyor, which dumps it into a slow-speed, high-torque shredder for initial size reduction to pieces no larger than a few inches.

Though MBA Polymers can do this initial size reduction, it is increasingly urging its suppliers to do it instead. One look at the firm's storage area shows why: Among the waiting scrap, a load of spent telephone casings makes towers, baled together with swaths of shrinkwrap and resting on wood pallets. Biddle leans over to pick up some casings off the ground. Shredded plastic scrap is not only easier for his employees to handle, he says, it's also more cost-effective for the supplier.

As he notes, "It's an extra process for them, but it's one that pays for itself in no time" because the suppliers save on shipping and storage. And MBA Polymers benefits by receiving a nice, tidy boxful of plastic chips rather than a box or bale of whole parts.

But back to the process…

During the initial size-reduction stage, metal and other contaminants such as labels, lint, and cork are liberated. Magnets remove much of the ferrous metal, while some of the nonferrous metal is ejected from the mix by an eddy-current separator. An air system, meanwhile, removes lighter contaminants such as foam, cork, and labels.

This initial process removes most, but not all, contaminants. Biddle reaches into a bin of plastics that have just been through the size-reduction process. He takes out a handful and finds a small, circular piece of cork—just one example of the type of contaminant that must be removed in the remaining parts of the process.

From here, the shredded plastic moves on to the sorting stages of the plant. Though Biddle can't go into great detail about the sorting technology—because much of it is proprietary—this is basically what happens: The shredded plastic first passes through additional air classification, screening, and metal removal steps. Then the material enters the wet processing stage, which involves a series of hydrocyclone separation systems that remove any remaining foreign material and separate plastics by density, which is reportedly faster than sink-float sorting methods. Highly proprietary separation techniques are then used to purify the materials further.

In essence, this combination of sorting approaches turns mixed engineering-grade plastics into streams of separated plastics.

On a Quality Quest

But that's not the end of the line.

Before any plastic can leave MBA

Though MBA Polymers can shred whole plastic products—such as the baled items above—it prefers to receive material already size-reduced (right). This practice saves both the company and its suppliers time and money, Mike Biddle says.

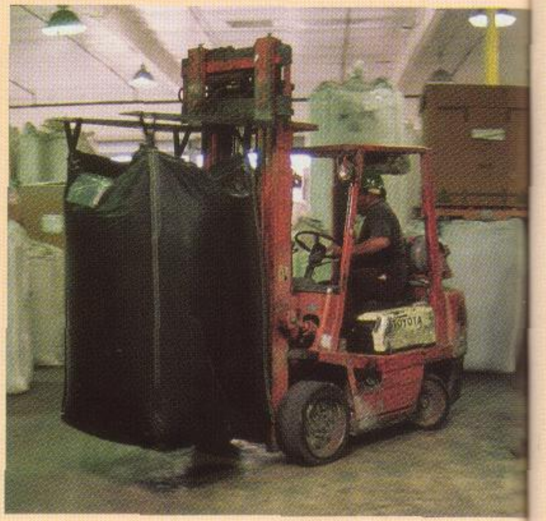
Polymers, it must undergo a rigorous series of tests. A small extruder produces pellets that are fed into a molding machine, which makes a variety of specifically shaped pieces to suit the different types of tests conducted by the firm.

"The tests are important. I have a Ph.D. in plastics and polymer science, and I can't tell you what this is by looking at it," Biddle says, holding a bag of ABS.

"We'll analyze it flake by flake," he asserts. "If I were to take a sample to a lab and ask it to tell me what each of the plastics are, it would charge me $1,000 and the process would take a week. We can get that answer in minutes."

Using an infrared spectrometer, Biddle can identify plastic types in a flash. The company then tests each load of plastic for impact strength, tensile strength, and other specific properties. Samples are also tested for their melt index. "We take our plastics and measure how much comes out at a given temperature," he says. "It's a measure of a plastic's viscosity. How easily does it flow when it's melted? This will be related to some of the properties and how it can be molded into parts."

This gauntlet of tests may seem extravagant, but it's absolutely necessary if MBA Polymers wants to sell its finished recycled plastics. Biddle is the first to admit that one of the toughest hurdles for the company has been convincing plastic consumers that its recycled plastic is as good as virgin resin. "What they buy is properties," he says. "We have to meet their needs for mechanical properties. We rely on these plastics to have the properties the customer wants and needs. I think that's initially the difficult thing. As recently as two years ago, the industry was skeptical. No one has ever tried to recycle postconsumer engineering-grade plastics before, so there's a convincing time."



An MBA Polymers employee moves a supersack full of finished product to storage prior to shipment.

Once a load of plastic passes all of these tests, the material is loaded into supersacks—enormous shipping bags that can hold 2,000 pounds. And this material, which arrived at MBA Polymers as a discard, is then ready to be sold and shipped as a valuable commodity. "If you bought virgin ABS from Dow," boasts Biddle, holding up a bag of his recycled plastic, "it would look just like that."

The Nucor of Plastic Recycling

As Biddle looks back at MBA Polymers' first five years, he likes to compare the firm to Nucor Corp. (Charlotte, N.C.), the renowned company that turned the steel industry on its head through its scrap-based minimill approach to steelmaking. As he explains, both companies faced a production challenge and both came up with technologies to overcome them.

Certainly, MBA Polymers has come a long way since its debut. What began as a research and development venture has been slowly moving toward becoming a commercially viable processor of scrap engineering plastics. The company has developed its techniques of recycling durable plastics to the point that it's ready to take its product to mass market.

Toward that goal, MBA Polymers has made a rather hefty capital investment. In the middle of its warehouse floor is a large extruder. The used machine, which Biddle says would cost $1 million new, will enable the company to transform its plastic flake into pellets, which he calls "the currency of the plastic industry."

As the company grows, its vision changes. As a research and development firm, MBA Polymers has explored the pros and cons of recycling many types of postconsumer durable products—from ski boots to an entire car dashboard. These items aren't cost-effective enough to warrant mass-scale recycling, however. For now, the company will stick with electronics and computer parts, says Biddle.

That's a wise decision given the flood of non-Y2K-compliant products that will likely need a recycling home after Jan. 1. And with its technological savvy, MBA Polymers could indeed emerge as the Nucor of durable plastic recycling in the new millennium.