



BLAZING THE PLASTIC RECYCLING TRAIL

IN THE PAST YEAR, MBA POLYMERS HAS OPENED TWO FACILITIES SHOWCASING ITS HIGH-TECH RECYCLING PROCESS FOR ENGINEERING PLASTICS. THOSE PLANTS—IN CHINA AND AUSTRIA—ARE JUST THE BEGINNING FOR THIS PLASTIC RECYCLING PIONEER.

BY ADAM MINTER

The Shanghai New Exposition Center has more than 1.1 million square feet of exhibition space that sprawl over two wings measuring one-quarter mile and one-third mile long, respectively. Few industry events could fill even a meaningful fraction of that space—except Chinaplas 2006. That event, Asia's largest plastic and rubber exhibition, packs all but one of the nine 125,000-square-foot exhibition halls.

Hall W4, located 10 minutes by foot from the exhibition entrance, houses

major international manufacturers such as BASF, DuPont, and Bayer; smaller chemical and raw material producers; plus a range of semi-finished product suppliers. Many of the bigger exhibitors have booths and presentations incorporating elaborate multimedia, live entertainment, and even on-site manufacturing.

Few, however, display anything as revolutionary as the plastic recycling process depicted in photos at the modest booth of MBA Polymers Inc. The simple truth is that MBA operates two



MBA Polymers has developed technology that can sort mixed engineering plastics (above) and produce virgin-quality recycled resin (top).

of the most advanced facilities in the world for recycling engineering plastics from durable products. The first, in Nansha, China, near Guangzhou, came online in November 2005. The other, in Kematen, Austria, started in March 2006. The company also operates a pilot-scale processing line at its headquarters in Richmond, Calif.

Standing in the MBA Polymers booth, holding a stainless steel bowl filled with mixed, shredded plastics from electronic products, is Mike Biddle, MBA's CEO. Since its founding in 1994, MBA has spent more than \$30 million to develop an advanced mechanical process for sorting such mixed engineering plastics and extruding them into virgin-quality recycled resin. MBA is determined to be the answer for manufacturers and recyclers pressured by e-recycling regulations such as Europe's waste electrical and electronic equipment law, known as the WEEE directive. "We want to grab our share of the mountains of material everywhere," Biddle says, "because right now it's being grabbed by others, like incinerators and landfills."

In addition, MBA is determined to be an answer for manufacturers that need high-quality plastics for consumer goods and other applications. That's a big reason why MBA opened its first commercial-scale plant in China. The country is "the fastest-growing market for plastics in the world," Biddle states, glancing around the vast Chinaplas exhibit floor, "and Guangzhou is one of the most important manufacturing centers in the world. Our system allows us to be competitive there."

GETTING THE BALL ROLLING

The Nansha Economic Development Zone is halfway between Guangzhou and Shenzhen in China's fast-growing southern province of Guangdong. Along the wide boulevard that leads to the development zone, Toyota is building a huge factory. GE Plastics is constructing its own massive facility along a riverbank just past that spot. Beside



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GMP's feedstock encompasses granulated, rotary-ground, shredded, and baled material from durable plastic products. Depending on the supplier's technology, the feedstock might contain nonplastic items such as metals, paper, and fluff at varying percentages, usually in the single digits each. Above, a GMP worker pours a granulated feedstock onto the infeed conveyor of the preprocess line, which extracts the nonplastic items from the mix.

it, on the other side of a narrow inlet, is a long, 20,000-square-meter building that houses MBA's joint-venture Chinese operation, named Guangzhou GISE-MBA New Plastics Technology Co. Ltd., or GMP.

Standing between the GE and GMP plants, Darren Arola, MBA's global director for product development and sales, notes that MBA originally planned to build this facility in Japan. That country's passage of e-recycling legislation early in the new millennium made it a natural site for MBA's process, he explains. But several factors—including high land costs and difficulty establishing a joint-venture partnership—kept those plans from fruition.

In the meantime, GE Plastics and Flextronics—both major MBA investors—encouraged the firm to consider building a plant in China, home to many of MBA's major customers. With a plant in China, they noted, the company could cheaply import e-scrap feedstock from Japan.

After six months of searching, MBA identified state-owned Guangzhou Iron & Steel Enterprises, the largest ferrous

recycler in Guangdong, as a likely partner. Two months later, in January 2004, the companies signed an agreement that granted GISE 45-percent ownership of the planned facility. The Chinese partner brought a lot to the table, including "expertise in metal recycling and in working with the government," Arola says as he leads the way to the back of the GMP building. The partners broke ground in June 2004 on land that used to be a banana plantation.

Arola pauses at a loading dock that opens to a conveyor belt. Hanging above it is an enormous plastic bag filled with roughly 1,000 kg of shredded engineering plastics imported from Europe. A worker maneuvers the bag over the belt and then literally pulls the plug on it, releasing a flood of fingernail-sized plastic flakes mixed with occasional pieces of rubber and metal. Arola watches the material rise on the conveyor belt, then he points toward the long line of sorting technologies that define the MBA process.

"The best way to think of our technology is that it is modular," he says.



China is the fastest-growing market for plastics in the world, making it an ideal place for MBA to promote its state-of-the-art plastic recycling technology. Above, MBA executives pause for a portrait just before the grand opening of the GMP facility in Nansha. Pictured are (left to right) Ron Rau, operations manager of the GMP plant; Darren Arola; Mike Biddle; Richard McCombs, MBA's president and CFO; and Arnold Lim, process engineer.

“Material streams require different sorting and separating modules to achieve the quality end product we need for extruding.” The company originally designed the GMP plant for the highly uniform mix of durable plastics from Japan’s regional recycling centers, but China’s recent nine-month ban on Japanese scrap plastic imports (due to medical waste found in several shipments in Qingdao in 2005) forced GMP to look elsewhere for feedstock.

No other country collects and concentrates plastics in the same manner or quantity as Japan. In Europe, for example, industry-specific recyclers—for televisions, say—generate the bulk of the feedstock, so the mix of plastics doesn’t match the uniform mix of durable plastics from Japan. Nevertheless, with Japan’s plastic exports only beginning to recover from the ban, GMP has had to rely on a different mix of recovered plastics from Europe, South Asia, and North

America. “The result is that our throughput in some of the modules is not maximized at this plant,” Arola says. “European and North American material simply can’t utilize our modules as efficiently as Japanese feedstock, but that doesn’t prevent us from processing these materials.”

In contrast, MBA designed its operation in Austria for the specific mix of durable plastics generated in Europe, largely as a result of the WEEE directive. “The technology is the same,” Arola notes, striding past 6-foot-tall bags of imported shredded plastics, “but the mix of modules is different.” To get the best results from its plants in Europe and China, MBA carefully evaluates its suppliers, requiring lab characterizations of every stream that enters the sorting line. Spot-buying of plastics is simply not an option.

Though it might seem logical for GMP to tap into China’s significant

stream of recovered engineering plastics from durable goods, Arola and GMP’s engineers have no immediate plans to do so. “We’re still learning about the Chinese waste stream and evaluating opportunities,” he says.

Plenty of Chinese plastic recyclers, particularly in Zhejiang and Guangdong provinces, already compete for the Chinese material, though none has the technological sophistication to achieve the quality and uniformity of MBA’s extruded resin. Typically, hand sorting and mixing are the preferred methods of processing in China. When they require fine differentiation, Chinese processors resort to what Arola describes as “burn and sniff.” Though these operations enjoy low labor costs, they can’t compete against GMP’s mechanical sorting process. In the end, hand sorting of engineering plastics is simply an inferior approach, resulting in higher costs and lower-quality end products.

WALKING THE LINE

Arola points out features of the pre-process line, the first stage of MBA’s process. This stage size-reduces the incoming material then extracts non-plastic items such as ferrous and nonferrous metals as well as light items like paper and fluff.

Like all of MBA’s technology, this preprocessing stage doesn’t use chemicals, but instead relies on mechanical processes and air. It is also highly proprietary, though MBA has been placing some of its technology at suppliers’ facilities. MBA is, after all, a plastics recycler and would rather have metal and other nonplastics removed prior to shipment. GMP’s plastic scrap import permit also restricts the quantity of metal that shipments can contain.

Arola continues along the pre-process line to a three-story concrete platform that houses massive silos that make up another proprietary portion of the MBA process. At the bottom are plastic bags slowly filling with byproducts culled by the process above. A range of materials, including wood and



GMP's massive 20,000-square-meter facility (left) is an important feature in the Nansha Economic Development Zone, located between Guangzhou and Shenzhen in Guangdong province. The company is a joint venture between MBA Polymers and state-owned Guangzhou Iron & Steel Enterprises, the largest ferrous recycler in Guangdong. Inside, the firm's immaculate plant (below) provides a showcase for its high-tech plastic recycling process.

metals, are separated from the feed, and the company carefully monitors the disposition of these byproducts. MBA's partner GISE receives all metals, while other materials go to processors and disposal sites that MBA audits to ensure that they use legal, environmentally sound methods. "Sometimes we'll even follow the trucks just to make sure that the materials are going where they're supposed to go," Arola says. Running at full capacity, the plant will generate roughly 15,000 mt of byproducts annually.

Arola continues through the factory, pausing to point out the advanced process area (APA), which contains a variety of unit operations devoted to sorting different types and grades of plastics. Sheet metal encloses the largest and most sensitive parts of the APA to shield MBA's most innovative technology from those who would misappropriate it. "There's no question that intellectual property protection was a primary concern before we came to China—and we are constantly vigilant," Arola says. Even if a competing firm did acquire MBA's technology, there's no guarantee the company could use it. "We have a lot of experience with this," Arola asserts, "and I don't think somebody could just come in and start their own line."

With that assumption, MBA has gone to extensive lengths to automate the Nansha plant, monitoring sections of it over the Internet. In addition to limiting the number of employees who know how to run the system, the high level of automation also allows MBA to save on travel and maintenance costs. "If there's a problem," Arola points out, "we don't necessarily need to fly someone from California or Austria to fix it. Maybe it can be fixed



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remotely by analyzing process data."

Just past the APA, Arola stops beside several workers as they prep MBA's extrusion and compounding lines. This "back end" of the plant produces high-quality plastics for MBA's manufacturing customers. In short, it's where the company generates revenue. The cost structure for the \$13 million plant reflects that fact: According to Arola, the facility's custom-made Chinese extruders were the most significant expense, accounting for 30 percent of total equipment costs.

At full capacity, the plant can produce 25,000 mt of virgin-quality polypropylene, ABS, and high-impact polystyrene annually. Arola sticks his hand into a bag of plastic pellets and checks their quality. "Our product can be just as good as what comes from a virgin plant," he says. "That's something I've been educating the manufacturing consumers about."

MBA does not separate material by

color at its China plant, though the company has this technology at its plant in California. "So what we produce is a gray or utility black color that works very well for internal and external parts that don't have high-end cosmetic requirements," Arola notes. MBA's extrusion and compounding technology allows for additives, including pigments, but the technical limitations caused by pigments already present in the plastic, in addition to economic considerations, make coloration less feasible. "So if people really want to support recycled plastics," he says, "they should support the use of gray or black components."

Upstairs, in GMP's second-floor offices, Arola rummages through a box of gray and black plastic television casings, gray and black plastic wire spools, gray plastic floppy disk housings, gray plastic fan bases, and other gray and black plastic parts and accessories manufactured from the firm's

plastics that demonstrate the multitude of applications that use gray or black plastics. "Right now we find a lot of acceptance for using this material as internal parts," Arola says. "One of our important accomplishments has been showing our customers that our products are as good and consistent as what they could get from a virgin resin factory."

Arola leads the way out of the office and down to GMP's on-site laboratory. Inside, a technician adjusts a newly molded strip of plastic in a machine that tests its mechanical properties. Next to that is a machine for testing melt-flow properties. Every production lot of extruded GMP plastic goes through such laboratory tests, and the company provides that information to manufacturers. "We need to be able to show that our product is consistent," Arola says, "because most plastic recyclers in China or elsewhere haven't been able to do that. I'm always running into engineers who've had bad experiences with recycled plastics but who are pleasantly surprised to learn that we provide material property data sheets."

Leaving the lab, Arola again walks the length of the plant, pausing to watch as newly extruded pellets are fed into 25-kg bags. Then he turns right, into a warehouse, where thousands of bags are stacked on pallets. Arola pauses to check on a delivery schedule and looks into the darkened room. "We're extruding everything we can get our hands on at this point," he says, "and we've got more demand for this kind of product than we can fulfill right now." He smiles and shrugs. "So far, so good."

A WIDE-OPEN FUTURE

From Mike Biddle's seat in MBA's small booth at Chinaplas 2006, the competition literally looms large: multinational plastic producers with decades of experience occupy exhibition areas many times larger than MBA's space. But Biddle isn't cowed by the size discrepancy. He knows MBA's plastic recycling system has

several advantages over virgin plastic operations, large or small.

"Cost and volume-wise, a new virgin resin plant will exceed ours by at least an order of magnitude," Biddle says. Virgin plastic facilities can cost \$100 million to \$500 million, he notes, but MBA's plants have cost less than an average of \$20 million. Another advantage is that MBA's process requires less than 10 percent of the energy it takes to make virgin plastic from petroleum. Also, MBA's feedstock is scrap, not oil, so skyrocketing petroleum prices don't affect its plants as directly. In addition, MBA's plants are less expensive to operate, Biddle says, and their recycled end products can boast a "green" marketing advantage.

With that many advantages, it's no wonder MBA Polymers plans to keep building new facilities. In the next two years, in fact, Biddle hopes to announce at least one additional European plant as well as another operation in Asia.

Ironically, though the United States is the largest source of scrapped durable plastics in the world, MBA has no immediate plans to build a full-scale North American plant. "The problem," Biddle sighs, "is that the North American material isn't collected or concentrated." Also, significant quantities of North American

scrap engineering plastics are shipped overseas, denying MBA and other plastic recyclers access to that feedstock. Until the United States passes its own version of WEEE legislation, or until the economics of plastics disposal change significantly, MBA's technology will likely remain an overseas phenomenon.

That said, MBA is working with several major North American and European shredder operators on ways to produce a higher-quality, higher-concentration stream of plastics from automobile and appliance shredding.

Going forward, Biddle sees one of his company's biggest hurdles as getting people to "believe that we do what we say we do, because it's so new." He laughs as he recounts groups of skeptical Japanese suppliers arriving in Nansha to inspect the plant, fully expecting to find hand sorting or other shortcuts. As he talks, curious Chinaplas attendees wander into the MBA booth and pick up one of the stainless steel bowls filled with shredded plastics. Biddle eyes the visitors, then—unable to resist—puts his hands on his hips and offers to answer questions. ■■

Adam Minter is a journalist based in Shanghai, where he writes about business and culture for U.S. and Chinese publications.



ADAM MINTER

In its on-site laboratory, GMP can conduct numerous tests on its recovered products, including their mechanical and melt-flow properties. The company tests every production lot of its final extruded plastic and makes that information available to customers. "We need to be able to show that our product is consistent and that it meets our customers' performance requirements," Darren Arola says.