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## In Toledo, the 'Glass City,' New Label: Made in China

By [JAMES T. AREDDY](#)

The Toledo Museum of Art's \$30 million Glass Pavilion is a symbol of America's "Glass City," and reflects the legacy of its local glassmakers.

A smudge on the image: The pavilion glass was imported from China, the new global powerhouse of the glass industry.

No one in the U.S. had the capability to satisfy cutting-edge architectural specifications for the curving pavilion, even though the 2006 job involved techniques advanced decades ago by Toledo inventors: bending and laminating glass. The pavilion features 360 thick glass panels, each up to 13.5 feet tall, eight feet wide and weighing over 1,300 pounds.

For years, the West focused on the threat from China's low-tech exporters like clothing and furniture makers. Glass represents how an even more potent challenge has arrived: sophisticated, capital-intensive businesses that boast high-tech expertise.

In industries where global demand has shifted to China, the pattern is repeated, from steel to locomotives and turbines to specialized glassworks. Chinese companies that have gorged on growth in the domestic market have managed in just a few years to close the gap on decades of technological innovation in the industrialized West.

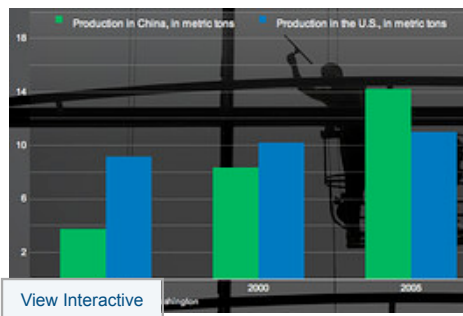
## China Closes the Gap



Getty Images

Bottles in their early form on a glass factory's production line

## Made in China



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Shenzhen, China-based [Avic Sanxin Co.](#) got the Toledo Glass Pavilion job because of its willingness to invest in technology necessary for complex glass, including a \$500,000 piece of equipment, says deputy general manager Bruce Tsin, who wears jeans and reads architectural magazines in English. U.S. companies, he says, are too cautious, preferring standardized processes and "easy money."

But China also has secured important technology from foreign glassmakers eager for a foothold in the world's biggest market. Foreign companies often play a balancing act in China, trying to protect selected manufacturing secrets and products.

Owens-Illinois Inc., an Ohio bottle-maker, intends to pump possibly hundreds of millions of dollars into Chinese acquisitions and joint ventures in the coming years. "It's the biggest glass market in the world and we feel underrepresented," says L. Richard Crawford, president of global glass operations. "What we bring the market is know-how."

Yet each deal will require approvals from Chinese authorities who have a reputation for pressuring foreign investors to introduce their latest proprietary technology, but a weak track record for protecting it.

Owens-Illinois says it will hold back key trade secrets locked in its suburban Toledo labs, like how to make jet black glass and 30% lighter wine bottles. Mr. Crawford says his company can succeed in China by introducing "the basic stuff."

Japan's Nippon Sheet Glass Co. this month said it would issue over \$570 million in new shares in part to fund \$53 million in planned spending on production lines that make energy-saving glass in the northern city Tianjin. Apple Inc.'s first Shanghai store opened in July featuring a tubular dome of glass panels 41 feet tall, all of it China made.

Northwest Ohio was aggressive about luring the glass industry in its early days, too. In the late 1880s, the area convinced East Coast glassmakers like Edward Drummond Libbey to relocate with cheap natural gas, cheap land and cheap labor—including workers as young as eight years old. Washington blocked European glass with tariffs. By 1900, the Toledo area had around 100 glassmakers. Mr. Libbey, who died in 1925, endowed the Toledo Museum of Art.

"China is the America of the 1880s, 1890s," says Quentin R. Skrabec Jr., an industrial historian at Ohio's University of Findlay. "Pittsburgh was the steel; Akron was the rubber; Toledo was the glass city."

Ohio companies like Owens-Illinois, Libbey-Owens-Ford Co., Owens Corning and Libbey Inc. automated

production of light bulbs, bottles and flat glass, supplied the Empire State Building with windows and commercialized fiberglass.

For decades, a major focus of Toledo was supplying glass to the rapidly expanding car industry of nearby Detroit. In the 1920s, the predecessor company to Libbey-Owens-Ford helped perfect the process of lamination to make windshields that didn't shatter into pieces. As the U.S. auto makers lost share in the 1980s to Japanese car makers, Toledo's glassmakers felt the pain.

Most of the world's flat glass comes from float lines, a tricky energy-intensive process in which molten glass flattens above a bed of hot tin and then is conveyed hundreds of feet in an unbroken ribbon while it cools. Float plants typically run 24 hours a day for years at a time.

There are 33 float lines in the U.S., according to Glass Magazine. Toledo has two of them, run by Nippon Sheet's Pilkington unit.

China has at least 150 float lines today. As recently as the early 1970s, the country was a tiny player in the glass industry. But the rapid growth in the Chinese construction and automotive industries since then has created surging demand for local glass.

The basic ingredients in glass, including silica sand and soda ash, are found almost everywhere. Because glass is heavy and difficult to transport, it is typically produced close to where it is used. China makes 45% of the world's glass, but it consumes virtually all of that amount. Every 15 minutes, its production is enough to clad a 100-story skyscraper.

Crowding a single Chinese city, Shahe, are 44 float lines. The Hebei Province city, 265 miles southwest of Beijing, makes around a fifth of the nation's flat glass.

In Shahe, Liu Jujun, owner of Hebei DaGuangMing Industry Group Co., recently inaugurated an 820-foot-long float glass line—adjacent to an identical one he opened last July.

"Whenever I go to other parts of the country, I see new buildings being built," says Mr. Liu, who is also a Shahe government adviser. "The more glass here, the more easily we can sell glass."

China's "Glass City" features a skyline of concrete cooling towers characteristic of nuclear power plants, not the expensive equipment Western glassmakers use to reduce pollutants like nitrogen oxide. Mr. Liu says 10% of his capital expenditure goes into pollution controls, that he meets all national standards and is switching to cleaner natural gas.

But Mr. Liu's plant features construction that looks slapdash by Western standards. It is run by engineers seated on wooden benches. A nearby silica sand producer spits mucky water onto the parched land. And trucks ply Shahe roads loaded with bags of synthetic soda ash, the product of a chemical process environmentalists forced out of the U.S. in 1985.

Most of China's glass output is such low quality, it has no market other than China. And much of the Chinese glass now hitting U.S. shores is chiseling into market extremities where profit margins are thinnest: the cheapest salt shakers, table tops and replacement windshields.

But China also is beginning to supply more sophisticated glass. Blast-resistant lower-floor windows for New York's One World Trade Center building under construction will come from northeast China's Shandong Jin Jing Technology Co. The U.S. company that is fabricating glass for the upper floors says it didn't have ability to make the large windows, which are nearly an inch thick and have V-shaped ridges in them.

"We try to hit the sweet spots in terms of volumes," explains Don McCann, architectural design manager at Viracon Inc. in Owatonna, Minn. "Our business model is geared toward the common sizes."

It was a similar story for the Toledo Museum of Art. Only a Chinese company and Spanish and Italian companies could produce the oversize curving panels needed for the futuristic design of its Glass Pavilion. Sanxin says it was paid under \$1 million; people involved in the project said it would have cost up to 50% more in Europe.

"We did get some grief about the fabrication until we explained we didn't have a choice," says Carol Bintz, an officer of the Toledo Museum of Art who led the project. "We couldn't find anyone in the United States that could do both the size and make the curvature."

To win prestige work, Sanxin spends money. For the Toledo museum, it put \$500,000 into the world's largest "autoclave," a giant blue cylinder that works like a pressure cooker to stick, or laminate, glass plates together.

"We were also quite proud to supply glass to a project like this," said Mr. Tsin, the general manager. "We believed after this project we had a chance to do similar things [elsewhere]."

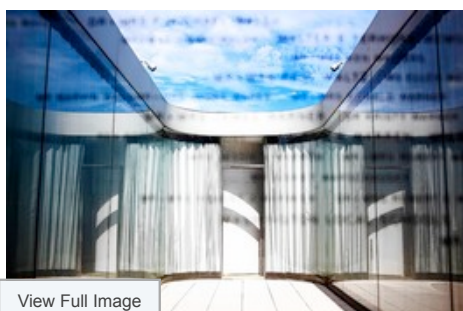
Not everything went smoothly for Sanxin in Toledo. At least one piece of glass arrived broken, and replacement glass had to be air-freighted to Toledo at high cost.

Still, the Toledo museum job helped win Sanxin recognition as one of the few companies anywhere able to take on certain highly specialized jobs involving curving or manipulating glass. It has worked on glass for a Paris airport, an Austrian subway, Tokyo storefronts and is supplying a museum in Anchorage, Alaska.

It has purchased equipment in hopes of fabricating glass for Apple's China expansion, but concedes it hasn't yet met the client's quality specifications.

Sanxin was founded as a private company in the 1990s and was listed on the Shenzhen Stock Exchange. Its biggest shareholder is Aviation Industry Corp. of China, a government-owned company that is a leading plane maker and military contractor. Among its biggest contracts in recent years have been Beijing and Shanghai airports.

Mr. Tsin rejects the notion that Sanxin has an unfair advantage because of its government links. Instead, he says Sanxin has developed a niche business in architectural glass because the world's established glassmakers want stable, high-volume production, not the risks of one-off jobs like the Toledo Museum of Art.



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Andrew Spear for The Wall Street Journal

The Toledo Museum of Art's \$30 million Glass Pavilion was made with sophisticated, curving glass panels imported from China.

Toledo glass fabricators, machinists, artisans and retailers understand that China is reordering the glass industry. "It hasn't really been felt yet except in isolated instances," says Paul Pellioni, vice president of Toledo Mirror & Glass Co., a major installer who worked on the museum. "It would be naive to say it's not a factor. It's going to be a factor."

But Toledo's main problem remains the big drop in Big Three auto sales. Toledo's glass industry currently employs just 2,500 workers. That is down from nearly 10,000 workers in 1973, according to Moody's Economy.com.

No one at the Source, a crowded Toledo job bank and training center, sees the glass industry as an elixir for 11%-plus

joblessness. "Manufacturing is fizzling out here," says Ken Nutter, a laid-off 54-year-old who worked as a glass cutter in the 1970s but not since.

When President Barack Obama last September bowed to union demands to levy tariffs on China-made tires, and later on steel pipe, he stirred hope in the U.S. glass industry, and its labor unions, that their sector might also get relief. It hasn't happened so far.

Last October, eight Democratic U.S. senators wrote to the Obama Administration asking it to challenge "Chinese

subsidization" of its glass sector. Separately, lawyers say a movement is building for a World Trade Organization case that would challenge Beijing to prove that production surges in sectors including glassmaking are commercially oriented, not government policy.

China's Ministry of Commerce warns any action to restrict its glass industry would backfire. Any U.S. glass industry woes, the ministry said in a statement, reflect weak domestic economic conditions.

For U.S. glass companies willing to deploy technology, the ministry added, China is "a rare opportunity and wide market to explore."

Near the Pilkington plant on Dixie Highway outside Toledo, patrons at "Moe's Place" refer to "Glass City" in the past tense. "We used to be a glass capital," they say, pointing to boarded-up houses. The plant, which makes windshields for farm equipment and big-rig trucks, now employs 300.

Next door to the plant, bulldozers are readying Toledo's post-glass gambit: "Hollywood Casino." Designed with an Art Deco facade of concrete on a spot where glass was first made in 1898, it promises 3,200 construction and casino jobs, or 260 more than the glassmaking plant had in 1970.

—Bai Lin in Shanghai and Sue Feng in Beijing contributed to this article.

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