

High-Purity Containers: Miraial Ensures Safe Travel for Silicon Wafers

By Naomi Shibuki



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Miraial: A Company Known by Those in the Know

During the roughly half a century since our founding in 1968, we have leveraged our strengths both in the research and development of high-performance plastic containers and in precision molding and processing technologies to generate original products that are indispensable for the electronic materials field and the semiconductor industry.

Ordinary consumers rarely see our major products, but we are proud to be a company known among industry players who are in the know. Without our company's products, it might be impossible to make the automobiles and electronic devices — televisions, personal computers, smartphones, etc. — that are so much a part of our everyday lives. Everyone knows IC chips are indispensable to the manufacture of electronic devices, but may not be as familiar with the silicon wafers from which they are made. Silicon wafers, as the name suggests, are the roughly 1-mm-thick slices of high-grade silicon ingot that are used as a substrate in the manufacture of IC chips. Such silicon wafers are sent from their manufacturers to chip makers around the world, like Samsung and Texas Instruments and IBM, where our products play a critical role as they are further processed into IC chips.

FOSB: Our Major Product

Our major product, with a global share exceeding 50%, is the front-opening shipping box (FOSB) (Photo 1). As the words “shipping box” make clear, FOSBs are containers for transporting things. Indeed, these plastic containers are used to transport the silicon wafers mentioned above (Photo 2). Although they may at first appear to be nothing more than oddly shaped boxes, there is a reason for their distinctive shape. They are also manufactured to strict size tolerances that do not permit variances of even 1 mm. Furthermore, the material used is no ordinary plastic: FOSBs are precision-formed from a high-purity, high-performance plastic developed in cooperation with a materials manufacturer. Such demanding specifications are needed because of

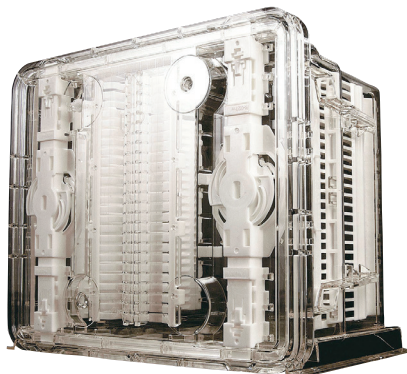
the delicate characteristics (fragility and purity) of the silicon wafers the FOSBs hold. In addition to being easily damaged by the slightest shock, silicon wafers are also 99.99999999% pure (“eleven nines”) and can be rendered useless in an instant through contact with impurities such as metallic or ionic compounds. It is no easy matter to safely transport such silicon wafers over long periods and long distances while maintaining their purity. Neither is it easy to develop a container that satisfies these demands nor to create and maintain a manufacturing environment for mass production. Indeed, many companies that tried to develop such a container were weeded out by the stringent criteria. Our company, however, was the first in Japan to bring to market FOSBs that conform to industry criteria, and before that PTFE (polytetrafluoroethylene) containers for the in-process transport of silicon wafers.

Maintaining Top Share through Manufacturing Skill

I mentioned above that our company's major product, the FOSB, has a majority share worldwide. This means both that our FOSBs are recognized around the world and that there is competition even in niche markets. How, then, have our products managed to capture and maintain such a dominant position even amid such competition?

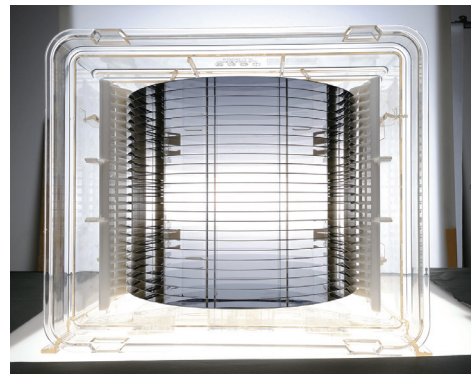
A major factor in capturing top share was our success in developing a product that conformed to the global standard before other companies were able to do so. In order to increase the number of chips that can be drawn from each silicon wafer, their diameter has grown progressively from 150 mm to 200 mm to 300 mm. Each diameter wafer requires its own dedicated container, and up through the 200-mm era there was no fixed standard; each company

Photo 1: Miraial Co.



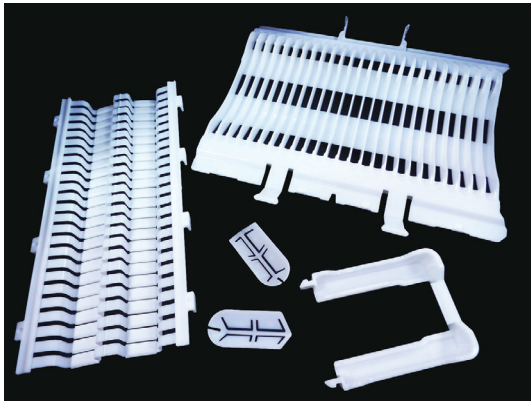
Our main product, the FOSB

Photo 2: Miraial Co.



Each box can hold as many as 25 silicon wafers.

Photo 3: Miraial Co.



FOSB parts. While other company products are all-in-one units, ours are made up of removable parts.

produced its own original product. The first effort to establish a global standard occurred during the transition to 300-mm wafers and our company was quick to get involved. Even as we took advantage of the Galapagos-like aspects of Japanese manufacturing, we were ahead of the competition in developing a product conforming to the global standard.

Photo 4: Miraial Co.



Robust quality assurance system, complete with chemical analysis facility

Photo 5: Miraial Co.



Each and every part undergoes inspection in a clean room.

Our company also benefited from favorable environmental factors. Much has been said about the poor state of the Japanese semiconductor industry, but because Japanese manufacturers still have an overwhelming share of the market for silicon wafers, our company has a geographical advantage in supplying containers for the transport of silicon wafers.

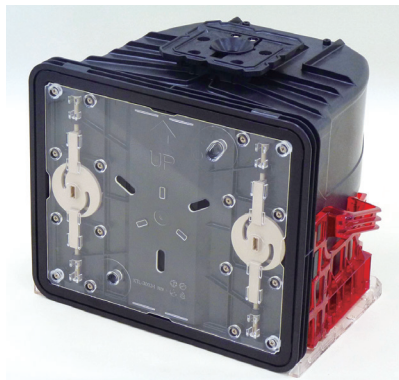
The product itself, of course, is also differentiated from those of competitors. With environmental pollution now a serious problem all around the world, our company's FOSBs are designed to be reused and recycled. While other companies' products are all-in-one units, ours can be disassembled; in the event of a problem with one part, the part can be replaced individually without needing to discard the entire assembly. It is also possible to combine parts to address specific customer needs ([Photo 3](#)).

In addition, our manufacturing is distinguished by the fact that we conduct the whole process stream in-house — from materials development through product design, mold design and manufacture, molding, testing, and shipping — and by our thorough quality assurance system including an in-house chemical analysis department ([Photos 4 & 5](#)). We also bolster our manufacturing skills by sourcing machines and equipment to make our production lines more efficient from within our own group, such as through technical collaborations with our subsidiary Sanjo Seiki Co., Ltd., a manufacturer of vertical injection molding machines ([Photo 6](#)).

Although many Japanese manufacturers are considering or have executed a shift to overseas production, our company has no overseas bases. Nor do we have any plans to establish any in the near future. Rather than taking the easy step of throwing ourselves into competition based on price, we will continue to produce high-value-added products in Japan while taking steps to reduce costs by increasing our on-site capabilities, refining the quality of our products, and improving production efficiency.

Niche Leader Aiming for Further Growth

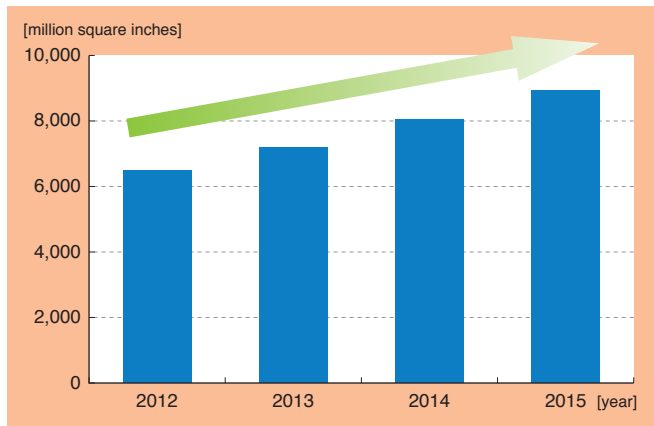
Photo 6: Miraial Co.



FOUP (front-opening unified pod) used for in-process transport. In addition to shipping containers, we also manufacture a variety of purpose-specific containers.

Since our company's founding, we have never once shown a loss. And with the enormous success of our current major product, the FOSB, we have consistently maintained double-digit operating profit margins ever since 2005 when we became a listed company (then on JASDAQ, now on the first section of the Tokyo Stock Exchange). As this track record shows, some of our company's greatest

CHART

Estimated 300-mm silicon wafer area shipments (Unit: million square inches)

"We expect continued growth because 300-mm wafers transported in our main product, the FOSB, continue to be a leading driver of the silicon wafer market."
Source: Miraial Co.

strengths are its management stability and high profitability. Our FOSBs are designed for shipping 300-mm silicon wafers. We expect this size to continue to drive growth in the silicon wafer market due to demand from switching from smaller 150-mm or 200-mm diameter wafers, and believe that our FOSBs will continue to function as a linchpin of profitability for some time (*Chart*). At the same time, however, given our position in a market that changes at a dizzying pace, we certainly cannot afford to be caught standing still. Although a full-scale transition from 300-mm to 450-mm diameter silicon wafers is not expected for a few years (around 2017-2018), global device manufacturers are steadily moving forward with development. Committed to make the most of this business opportunity, we are pursuing the development of a shipping container for 450-mm wafers and have already entered the improvement and sales promotion phase. Just as with the transition to 300 mm, by the time mass production of 450-mm silicon wafers begins in earnest our company's containers are sure to have set the standard for the industry.

Naturally, developing shipping containers for 450-mm wafers is not the only thing we are working on. Funded by profits from the success of the FOSB, we are seeking out and cultivating new businesses in fields where we can leverage our core competency in high-performance plastic molding technology. In addition to internal resources such as new applications for existing products and meeting the unmet needs of existing customers, this may also include external resources such as M&A or collaborations among industry, academia, and government. In any case, our company will continue aiming for niche markets, unwavering in our commitment to remaining a top-of-niche company. Rather than engaging in price competition with things that can be made anywhere, we will compete with products that only we can make.

Our company name, Miraial, combines the Japanese words for

Photo 7: Miraial Co.



Exterior of the Sumiyoshi Plant, our main production facility

"future" (*mirai*) and "have" (*aru*), and means "a company with a future". We believe the future is not something to wait around for but something we must create with our own hands. With our strengths in core technologies cultivated since our founding, our ability to react organically in collaboration with group companies, and new products and technologies we have yet to develop, we are pushing into the future while maintaining our presence as a top-of-niche company.

Company history

1968	Kakizaki Manufacturing Co., Ltd. (currently Miraial Co., Ltd.) established to manufacture and sell high-performance plastic products.
1969	Succeeded in commercialization of silicon wafer cassettes made of fluorocarbon resin FEP for the first time in Japan.
1995	Participated in first international 300-mm standard meeting.
1999	Started sales of 300-mm silicon wafer shipping container, the FOSB.
2001	Constructed Sumiyoshi Plant (Plant No.1) at Kumamoto Operations Office, specializing in manufacture of 300-mm silicon wafer shipping containers.
2003	Changed company name to Miraial Co., Ltd. Constructed Sumiyoshi Plant (Plant No.2) at Kumamoto Operations Office, specializing in the manufacture of 300-mm silicon wafer shipping containers.
2005	Listed stock on the JASDAQ Securities Exchange.
2006	Acquired stake in Sanjo Seiki Co., Ltd. to make it a subsidiary.
2007	Constructed Sumiyoshi Plant (Plant No.3) to specialize in the manufacture of 300-mm silicon wafer shipping containers to meet increased demand.
2011	Listed stock on the Second Section of the Tokyo Stock Exchange.
2012	Listed stock on the First Section of the Tokyo Stock Exchange.

Source: Miraial Co.

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