

Semiconductor Materials Global Top Management Roundtable

Semiconductor Materials Business: Key to Resonac's Growth

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The Semiconductor Materials Business is positioned as a growth business in Resonac's long-term vision. With strong demand expected to continue over the long term, there are growing customer demands for further strengthening of technological development capabilities and supply chain management including product supply, environment, and human rights, and Resonac recognizes the need to respond proactively to these demands.

Hiroyuki Yamashita, who oversees the Electronics Business, the heads of sales in the U.S., Taiwan, and Singapore, as well as CSO Tomomitsu Maoka, all gathered to discuss Resonac's strategies, challenges, and responses.

Characteristics of the Semiconductor Materials Business and Reason for Resonac's Role

Maoka: Currently, the global semiconductor business is undergoing a period of drastic change as countries are enclosing their production bases. The semiconductor materials field, which is Resonac's main business, is expected to grow in line with the increasing demand for semiconductors, with a CAGR of 5.2% until 2025. In particular, double-digit growth rates are expected for materials for high-performance semiconductors, which is our focus.

Yamashita: The Semiconductor Materials Business is characterized by the fact that it is difficult to commoditize products because it is necessary to communicate with customers collaboratively in pursuit of miniaturization and package complexity. Resonac, which has a large number of products with the world's top market share, is able to keep abreast of technological trends and customer needs through communication with customers, and is always ahead of the curve in technological development.

The semiconductor materials business has high barriers to entry. Resonac, born from the integration of Showa Denko and Hitachi Chemical, has developed a number of world-class semiconductor materials and leads the industry.

[Maoka]



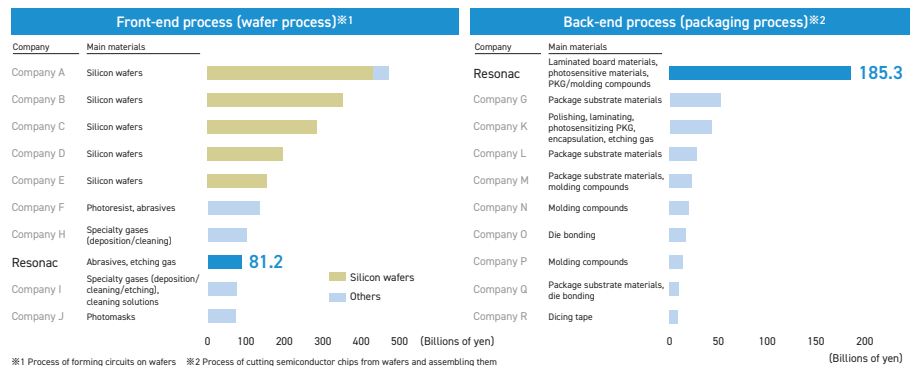
Maoka: Production processes that are determined as a result of communication tend to avoid change. The material design of semiconductor materials is highly challenging, requiring optimization by integrating electrical engineering, thermodynamics, structural mechanics, and physical property chemistry. It is a business with high barriers to entry.

Yamashita: This is a field where Resonac's long-standing relationships of trust with its customers come into play. Another advantage is Resonac's unique positioning within the semiconductor materials industry. Most semiconductor material manufacturers are niche market players that demonstrate strength in a few products, and there are not many players like Resonac that are involved in multiple products with high market shares.

Maoka: In the age to come, as semiconductor manufacturing becomes increasingly enclosed within each country, semiconductor material manufacturers will need to expand their production bases in each country, and they will need to be large in size to survive. This is why M&A is becoming more active, and Resonac has become a pioneer in this field.

Yamashita: Resonac has products with a high market share in the front-end and back-end processes of semiconductor production. Until now, technological innovation in semiconductors has been driven by front-end processes, which are responsible for the miniaturization of circuits formed on silicon wafers. However, with the 2 nm process approaching, further miniaturization has become difficult, and it will be necessary to achieve higher functionality through back-end mounting technology. In this back-end process, multiple materials are used to achieve high functionality, and the complex three-dimensional structure of a so-called 2.X-dimension package requires the optimal combination of more than 10 materials. Resonac excels at matching up with its customers, which is why Resonac continues to grow with back-end materials accounting for approximately 70% in semiconductor materials sales.

Resonac's position in the front-end and back-end processes of semiconductor manufacturing

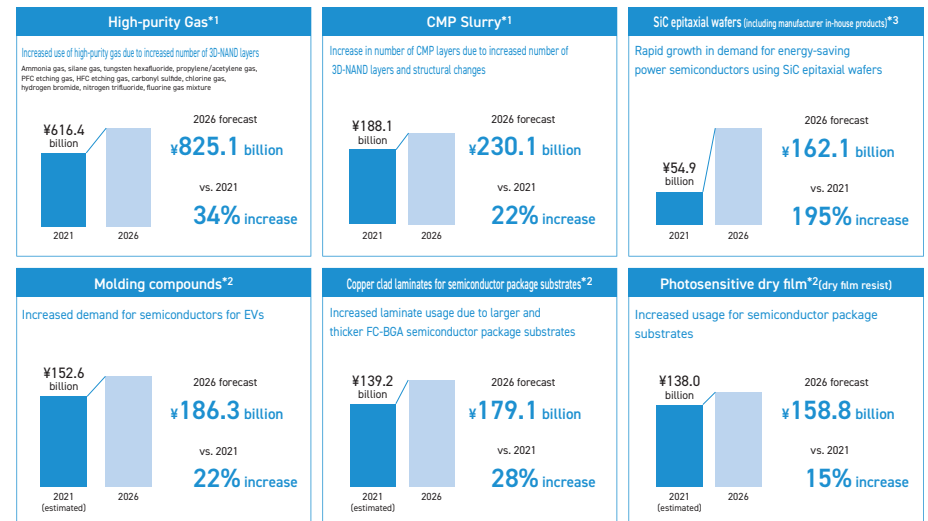


※1 Process of forming circuits on wafers ※2 Process of cutting semiconductor chips from wafers and assembling them
Source: Company research (as of November 2022)

Resonac's Semiconductor Materials Business Strategy

Maoka: Going forward, materials in which we have a high market share are also expected to grow across the board. We have positioned the Semiconductor Materials Business as our growth business, and our business and corporate headquarters will work together to analyze management resources and the external environment, set viable strategies based on cost-effectiveness and feasibility, and make focused investments.

Growth projection for semiconductor materials, in which the company has a high market share



Source: ^{*1} Fuji Keizai, "2022 Current Status and Future Prospects of the Semiconductor Materials Market"
^{*2} Fuji Chimera Research Institute, "2021 New Materials Handbook for Electronics Packaging"
^{*3} Compound Semiconductor Market Monitor, Module L, Q2 2022, prepared by the Company based on data from Yole Intelligence three companies (as of November 2022)
Remarks: High-purity gas, CMP slurry, and SiC epitaxial wafers are converted to ¥130 per dollar.

Investing over ¥250.0 billion over the next five years. Resonac, which has many products with the world's No. 1 market share in the semiconductor materials field, will formulate a strategy based on risk analysis and promote co-creation on a global basis to fulfill its societal role.

[Yamashita]





In the U.S. market, where cutting-edge technology is in high demand, it makes a lot of sense for Resonac to take the lead in expanding co-creation efforts. [Dennis]

Yamashita: In 2022, sales increased on the back of strong demand for semiconductors. On the other hand, operating income decreased due to the time lag in the transfer of raw material price hikes to selling prices and other factors. In 2023, demand and inventory adjustment trends are becoming increasingly uncertain, and it is extremely difficult to foresee the timing of recovery from the adjustment. Although the current external environment is severe, the semiconductor market will continue to expand over the medium- to long-term, and we want to make forward-looking investments for the next several years. We will execute timely capital investments commensurate with the growth of the semiconductor market, especially strategic investments related to increased production, rationalization, and new products, to ensure a steady return on our investment.

Strengthening of Development Capabilities and Co-creation in Line with Market Speed

Dennis: Resonac's presence in the U.S. market has been also increasing, especially in recent years, including inquiries for etching gases and CMP slurries. Customers demand high levels of technology, and Resonac America, Inc. is working together with its customers to develop advanced design and manufacturing technologies.



Yamashita: We keep recognizing the importance of meeting customer expectations, strengthening our development capabilities to keep up with the speed of the market, and accelerating the launch of new products. To this end, we are considering the possibility of establishing in the U.S. a function similar to the Packaging Solutions Center that we have established in Japan. We would like to make this a place for co-creation with semiconductor, materials and equipment manufacturers, as well as a place to consolidate information on advanced technologies.

Maoka: In the U.S., the Chips Act is creating a unique semiconductor ecosystem. By entering this ecosystem, rather than maintaining the status quo, we will have the opportunity to acquire information on cutting-edge packages and to use our own materials in the early development phase, aiming to continue to be the global No. 1 in back-end processes. In fact, overseas customers who have observed our co-creation efforts in Japan have been both surprised and highly impressed. We expect that this co-creation will also help differentiate the Japanese semiconductor industry itself.

Dennis: In the U.S. market, where cutting-edge technology is in high demand, we believe it is very meaningful for Resonac to take the lead in expanding this kind of co-creation initiative in order to increase its presence.

Regional Strategies and Supply Chain Management

Dennis: As geopolitical risks increase, major semiconductor manufacturers are increasing their investments and facilities in the U.S., and demand for semiconductor materials in the U.S. is also growing. Improvements are expected for our supply chain, which produces and fills products at our production facilities in Asia and transports them to the United States.

Sim: One of the major issues in the Asian region, especially in Singapore, is supply chain issues. Aiming to maintain stable supply and competitiveness, we are building a supply chain system and centrally managing information in the Indo-Pacific region. In April 2023, we presented a case study on our global supply chain system in Malaysia. Due to environmental issues, production and logistics constraints, and geopolitical risks, there is a need to reduce risks and improve the efficiency of the entire semiconductor supply chain.

Maoka: To address these issues, we have placed a dedicated liaison in the Corporate Planning Department at our head office since April 2022. As one of the leaders in the semiconductor materials industry, we plan to work with the Ministry of Economy, Trade and Industry to expand our activities to reduce risks and improve efficiency throughout the supply chain.

In response to the demand to reduce risks and improve efficiency throughout the supply chain, including business continuity, the environment, and human rights, the Singapore base is also promoting proactive information management. [Sim]





In response to the expected strong demand in the semiconductor materials field, we have made large-scale investments in Taiwan to increase production capacity for nanoceria slurries and copper clad laminates. We are also preparing for geopolitical risks. [Tsai]

Tsai: In order to build a foundation for growth in Taiwan, we have been making efforts with a focus on acquiring new projects in cutting-edge and growing fields such as next-generation communications (5G), HPC, AI, and xEV, which are key trends. In January of this year, Resonac Semiconductor Materials (Taiwan) Co., Ltd. expanded its production capacity for nanoceria slurries, which are used in the formation process of semiconductor logic circuits for cutting-edge devices, to meet the rapidly growing demand in these growth fields. In July, the company also increased the capacity of its ceria slurries, which can achieve both high polishing speed and low scratches. Likewise, we plan to increase our production capacity of copper clad laminates for semiconductor package substrates by 2025 with the introduction of new production lines and equipment.

Yamashita: On the other hand, we have many customers in China and Taiwan, and our business strategy requires us to closely monitor the trends and purchasing strategies of our customers in Greater China, including end users. The Electronics Business Headquarters, which I lead, has a high ratio of employees in Greater China, about 30%, and I believe that risk management, including employee employment and safety management, is important.

Maoka: In the semiconductor industry, with the major technologies being held by the U.S. and manufacturing in Taiwan and materials in Japan, the division of labor is divided by country. Monitoring geopolitics and business continuity management (BCM) are becoming increasingly important. We are working with the governments and administrations of each country, gathering information and advancing scenario planning, to establish a system capable of immediate response.

Sim: We recognize that issues such as the environment and human rights are also important matters demanded by society and our customers, and we at the front lines of sales are determined to respond with a high level of awareness. More and more, we recognize the need to collaborate with customers, suppliers, and our colleagues at Resonac around the world.

As a Leader in the Global Semiconductor Materials Business

Maoka: Resonac has many products with the world's No. 1 share in the semiconductor materials field, and we view our responsibility to society as very important. The rapid deterioration of the global economy and the decline in consumer demand are affecting the semiconductor market as well, and it is currently difficult to determine at what point the market will recover. However, the semiconductor market will continue to expand in the long-term. With an eye on a sudden recovery, we will continue to monitor market trends and work to obtain early information on the timing of a demand recovery.

Yamashita: Our business headquarters' three-year plan through 2025 focuses on developing new products and providing one-stop solutions centered on semiconductor materials, achieving highly efficient operations by strengthening supply chain management, and building strong partnerships in the value chain.

Maoka: It is all about co-creation, isn't it. What can be solved by a single company will become less and less. Resonac will drive the global semiconductor materials business by creating together with all stakeholders.

Yamashita: Through semiconductor materials, we will support the future development of digital society and contribute to sustainable social development.

