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OVERVIEW OF GLOBAL AND CHINA'S SEMICONDUCTOR MATERIALS INDUSTRY

As a core pillar of modern information technology, the semiconductor industry boasts a large market scale and strong growth potential. The global market size of integrated circuits reached approximately US$680 billion in 2025, and is expected to surpass US$1.3 trillion by 2030. While integrated circuits continue to iterate and upgrade, semiconductor display panels maintain steady growth, widely used in consumer electronics, automotive electronics, new-type display terminals and other fields. Together, they form the key pillars of demand for the semiconductor industry.

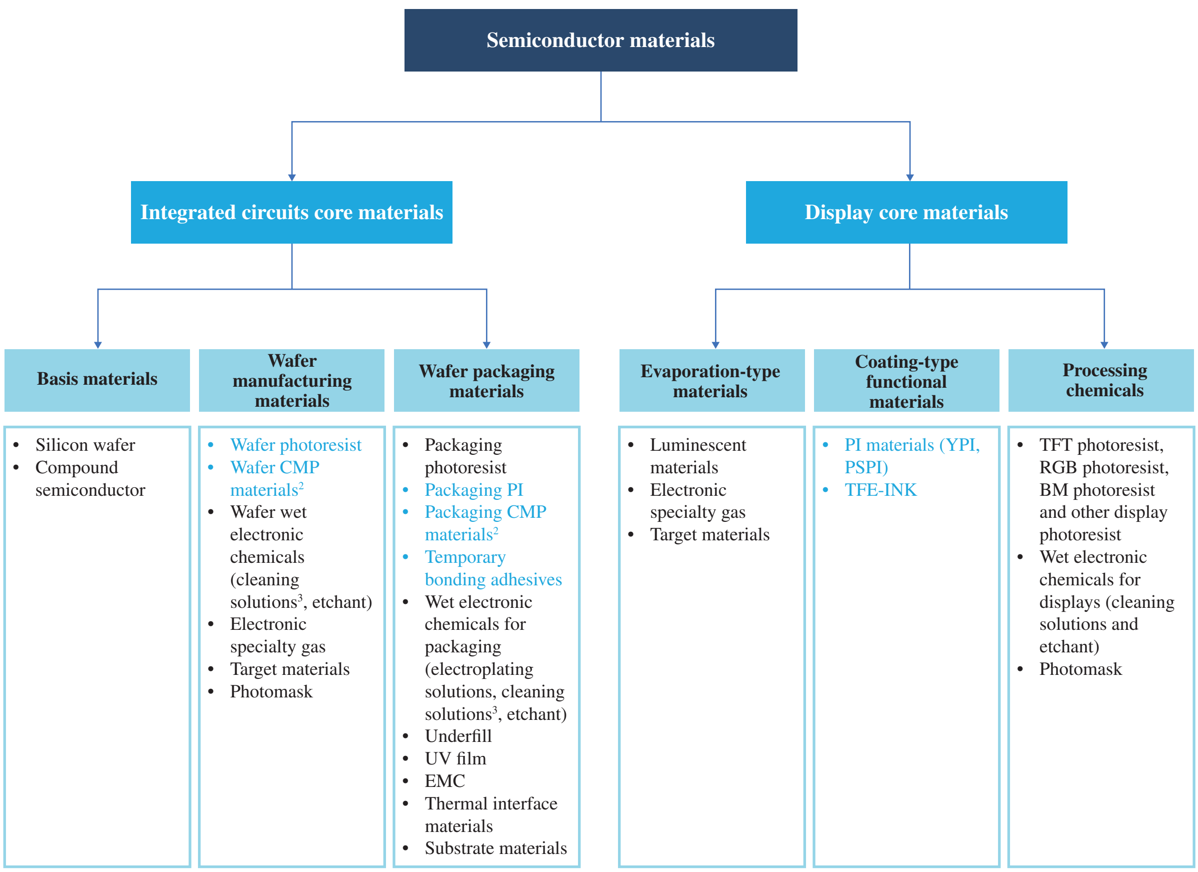
Driven by expanding end-user demand and diversifying application scenarios, the semiconductor industry is evolving toward higher performance, miniaturization and enhanced reliability. Chips are continuously improving in computing power and integration to support demands in AI, cloud computing, high-performance computing and other applications. Display panels are being constantly upgraded in terms of resolution, display precision and multi-form display, to satisfy the increasingly higher requirements for visual experience and reliability in consumer electronics, automotive displays and other scenarios. Meanwhile, the surging demand for large AI model training and inference is driving the accelerated development of advanced packaging, high-bandwidth memory (HBM), high-speed interconnection and other technologies, which raises the bar for the performance of semiconductor materials such as photoresists and packaging materials. These trends are jointly pushing for continuous improvements in process precision, production efficiency and yield control across key links including chip design, manufacturing and testing. As process complexity increases and the demand for precision manufacturing grows, the semiconductor industry sets higher standards for the performance stability, consistency and process compatibility of basic materials. As semiconductor materials are pivotal to the production of chips and display panels, their technological progress is increasingly becoming an important driver of the evolution of advanced processes and industrial upgrading.

Introduction to the Semiconductor Materials Industry

Semiconductor materials are essential functional materials for integrated circuits and semiconductor displays, underpinning process implementation, stable product performance and large-scale mass production. Based on application scenarios, semiconductor materials include: core materials for integrated circuits and displays. As integrated circuits and new-type display panels have much in common in the underlying technologies adopted in micromanufacturing processes, including photolithography, development and etching, the above two materials exhibit strong similarities and industrial synergy in R&D philosophy, core formulation and production processes.

The performance of semiconductor materials directly affects the process precision, production yield and product reliability in chip and panel manufacturing. With the continuous evolution of integrated circuit processes, increasing penetration of advanced packaging, and accelerated development of new-type display technologies, downstream applications impose higher requirements on the materials in terms of purity control, particle size distribution, interface stability, process compatibility and batch-to-batch consistency. Meanwhile, the scaling up and automation of wafer and display panel production lines place higher demands on material suppliers regarding delivery stability, technical service responsiveness, and integrated solutions. Driven by the growing market demand and technological upgrading, as well as the synergy from underlying technologies between integrated circuit and display materials, semiconductor materials play a growing supporting and strategic role in the industrial chain.

By product type, integrated circuits core materials mainly include basis materials, wafer manufacturing materials and wafer packaging materials. Display core materials mainly include evaporation-type materials, coating-type functional materials and processing chemicals.



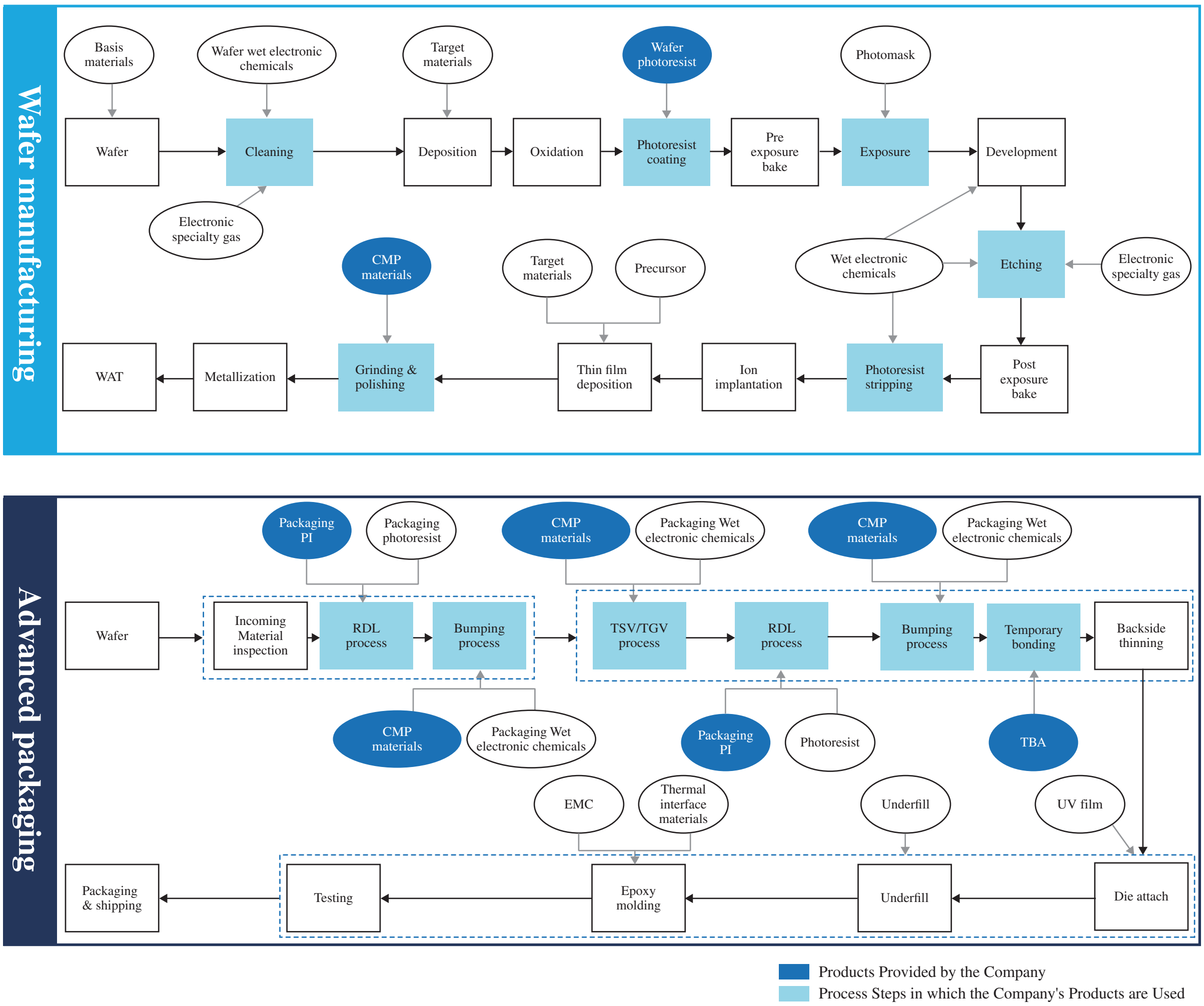
Notes:

1. Blue-highlighted sections: Products provided by the Company

2. CMP materials mainly include CMP Pads, CMP Slurry and Cleaning Solutions

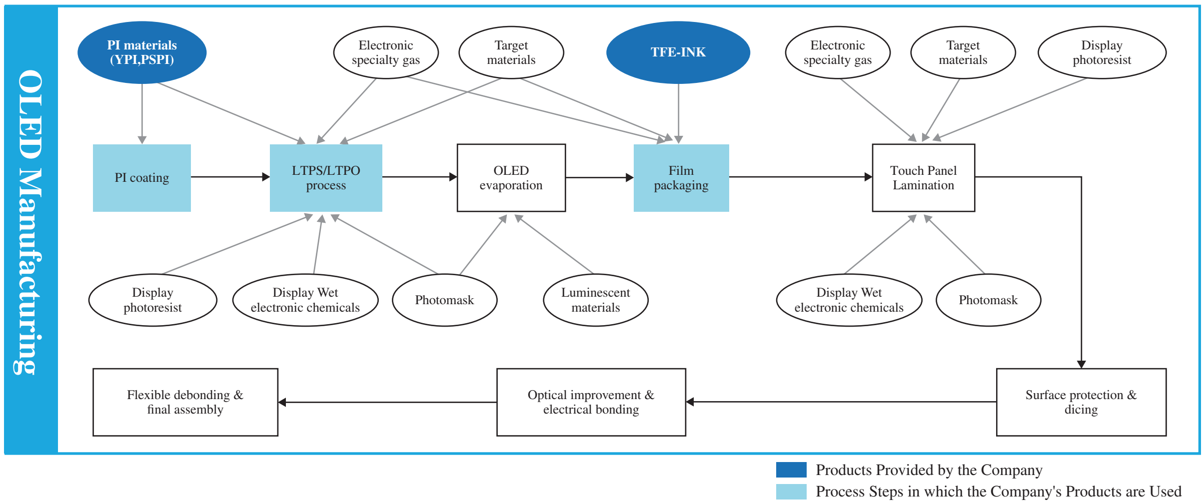
3. Excluding cleaning solutions used for CMP materials

The chart below presents an analysis of the core semiconductor materials used in the integrated circuit manufacturing process.



Note: The advanced packaging in the chart refers to the 2.5/3D packaging process.

The chart below presents an analysis of the core semiconductor materials used in the manufacturing process of OLED display panels.



The Semiconductor Materials Industry Value Chain

The upstream of integrated circuits core materials market includes basic chemicals, high-purity inorganic materials, and engineering equipment. The midstream sector focuses on the R&D and processing of integrated circuits core materials. Featuring the highest technical barriers in the industrial chain, it ensures the physical and chemical properties and process compatibility of materials, thereby guaranteeing the yield rate and process stability of mass production in wafer manufacturing, packaging and testing. The downstream sector mainly covers integrated circuit wafer manufacturing, packaging and testing, providing performance feedback and demand guidance for midstream materials through stringent validation criteria.

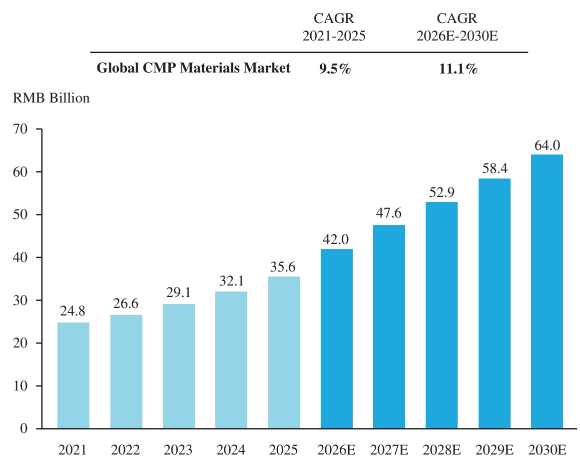
The upstream sector of the display core materials mainly comprises basic raw materials including polymer materials. The midstream sector undertakes the R&D and large-scale production of display materials to secure the optical performance, electrical performance as well as physical and chemical stability of display panels. The downstream sector focuses on the manufacturing of semiconductor display panels, with the products widely applied in consumer electronics, automotive electronics and other fields.

Global and China's CMP Materials Market

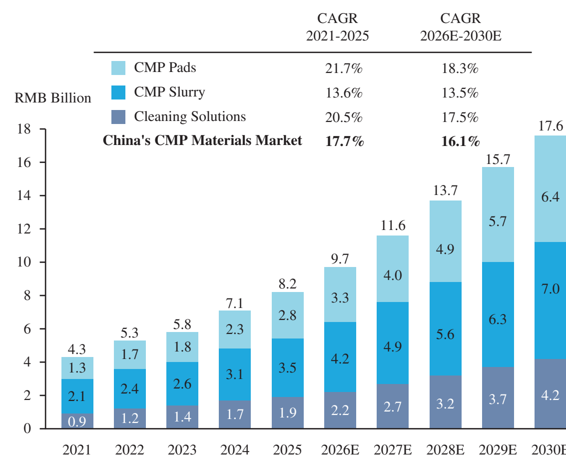
CMP materials are the key functional materials for the planarization of wafer surfaces during integrated circuit manufacturing. They directly determine the precision and yield of subsequent core processes including photolithography, deposition and etching, and can also be applied in advanced packaging and other critical manufacturing processes. According to SEMI data, CMP materials account for approximately 7% of the total material costs in integrated circuit manufacturing, mainly including CMP Pads, CMP Slurry and Cleaning Solutions. CMP Pads, CMP Slurry, and Cleaning Solutions collectively account for over 85% of the cost of CMP materials. With the continuous expansion of the semiconductor industry and the ongoing evolution of advanced process nodes, and the growing structural complexity and increasing stacking layers of logic and memory chips, the number of CMP processes in wafer manufacturing has risen markedly. This has driven increases in the usage of CMP materials and consumption per wafer, further expanding the market scale and technological value of such materials.

Driven by the upgrade of the global semiconductor industry toward advanced processes and the rapid development of emerging applications such as 5G, AI and IoT, global and China's CMP materials markets keep expanding. Driven by the large-scale expansion of domestic wafer foundry capacity and the continuous improvement of the semiconductor industrial chain ecosystem, China's market is growing faster than the global market. Core segments including CMP Pads, CMP Slurry and Cleaning Solutions see rapid development. Leading domestic companies continue to increase investment in the research and development of high-end products, gradually achieving breakthroughs in critical process and material technologies. They have successfully progressed from laboratory validation to volume adoption on wafer fabrication production lines, with both their technological capabilities and commercialization capacity continuing to improve.

Market Size of Global CMP Materials, 2021–2030E



Market Size of China's CMP Materials, by Type, 2021–2030E



Source: *SEMI, F&S*

Notes:

1. China's market size includes sales by both domestic and international suppliers;

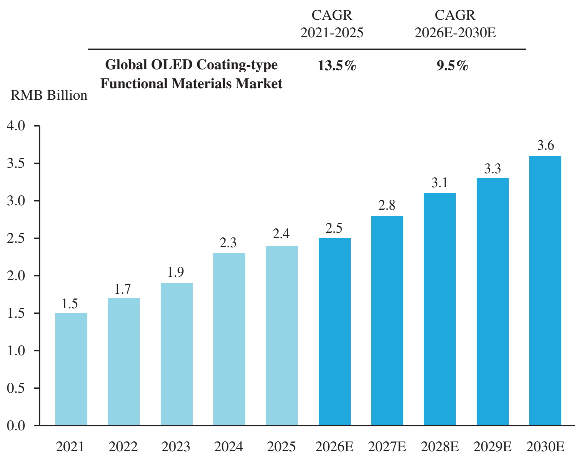
2. CMP materials mainly include CMP Pads, CMP Slurry and Cleaning Solutions.

Global and China's Semiconductor Display Materials — OLED Coating-Type Functional Materials Market

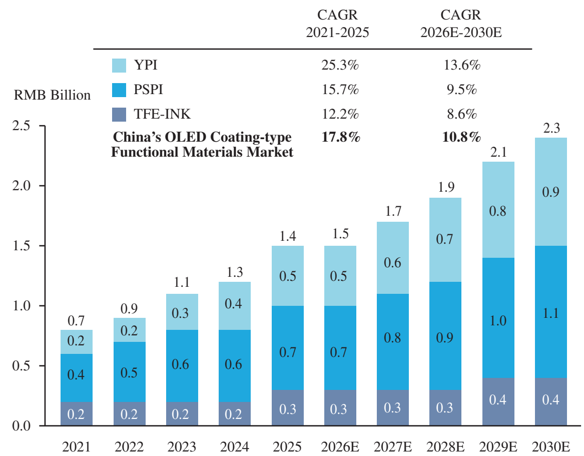
Semiconductor display materials are mainly applied in the production and functional structures of display panels, serving as a critical support for the high resolution, high contrast, high reliability and flexibility of display devices. OLED display materials represent a mainstream development trend at present. Semiconductor display materials mainly include evaporation-type materials, coating-type functional materials and processing chemicals. Among them, coating-type functional materials primarily include polyimide (PI) materials such as YPI and PSPI, as well as TFE-INK, which are typically applied as a liquid via precision coating processes to form a uniform functional film that remains permanently embedded within the device structure. Boasting superior film-forming property, excellent process compatibility and strong functional integration, they are widely used in the core processes of OLED panels, including substrate, pixel definition layer and film packaging.

Global and China's semiconductor display materials markets are growing continuously. This is mainly driven by the increasing adoption of emerging display technologies represented by OLED, as well as the accelerated penetration of large-size, high-refresh-rate and ultra-high-definition display panels. Fueled by the continuous launch of large-scale panel production lines, rapid ramp-up of flexible OLED production capacity, and booming demand for automotive displays in the smart cockpits of new energy vehicles, China's market is growing faster than the global market. In the future, with the gradual maturity of next-generation immersive terminals such as XR devices and the further penetration of innovative products such as foldable screens, global and China's market size of OLED coating-type functional materials is expected to keep expanding, holding enormous market potential.

Market Size of Global OLED Coating-type Functional Materials, 2021–2030E



Market Size of China's OLED Coating-type Functional Materials, by Type, 2021–2030E



Source: F&S

Notes:

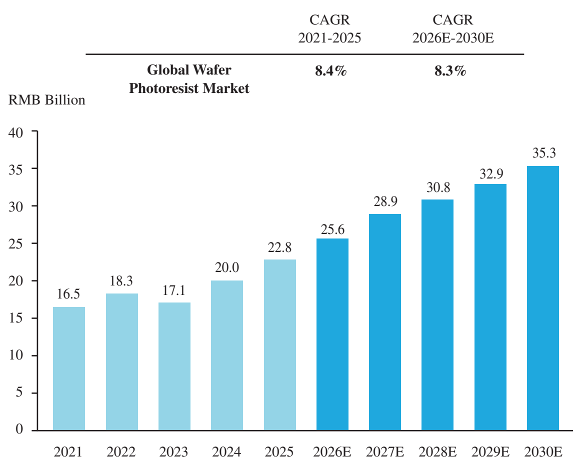
1. China's market size includes sales by both domestic and international suppliers;
2. OLED coating-type functional materials mainly include YPI, PSPI and TFE-INK.

Global and China's Semiconductor Wafer Photoresists Market

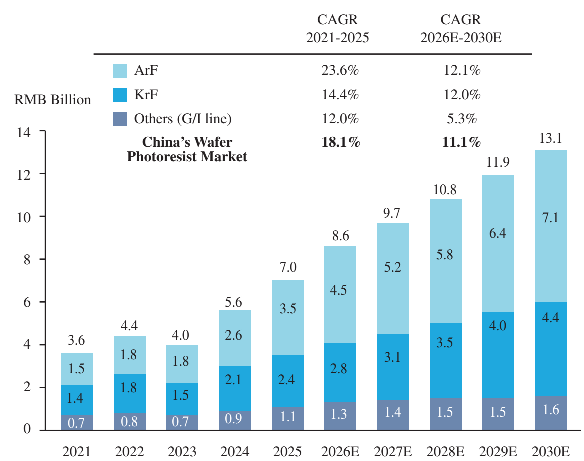
As a critical material for chip manufacturing, wafer photoresist can precisely transfer circuit patterns from photomasks onto silicon wafers. The performance of photoresists determines the level of chip integration and directly affects instruction cycle time, power consumption, and manufacturing cost, making it a critical enabler of semiconductor process scaling. By photosensitive wavelength, wafer photoresists are mainly classified into G-line (436nm), I-line (365nm), KrF (248nm) and ArF (193nm), which are crucial to semiconductor manufacturing. Among the aforementioned categories, high-end wafer photoresists primarily refer to KrF and ArF photoresists. This is mainly because these materials utilize shorter exposure wavelengths, enabling significantly higher lithographic resolution. Such high-resolution capabilities directly address the stringent requirements of advanced semiconductor manufacturing processes for finer feature sizes and higher integration density. As a result, they serve as a critical technological barrier supporting the continued evolution of wafer fabrication toward advanced nanometer-scale process nodes while ensuring chip performance and production yield.

Driven by industrial recovery and the capacity ramp-up of advanced processes, the global wafer photoresist market demand is expected to see robust growth in the years ahead. In China, the wafer photoresist market is growing rapidly, with a growth rate faster than that of the global market. In terms of product type, high-end wafer photoresists (ArF and KrF) have become the core driver of market growth due to their premium pricing and high technological barriers, and are expected to dominate the market in the future.

Market Size of Global Wafer Photoresists, 2021–2030E



Market Size of China's Wafer Photoresists, by Type, 2021–2030E



Source: SEMI, F&S

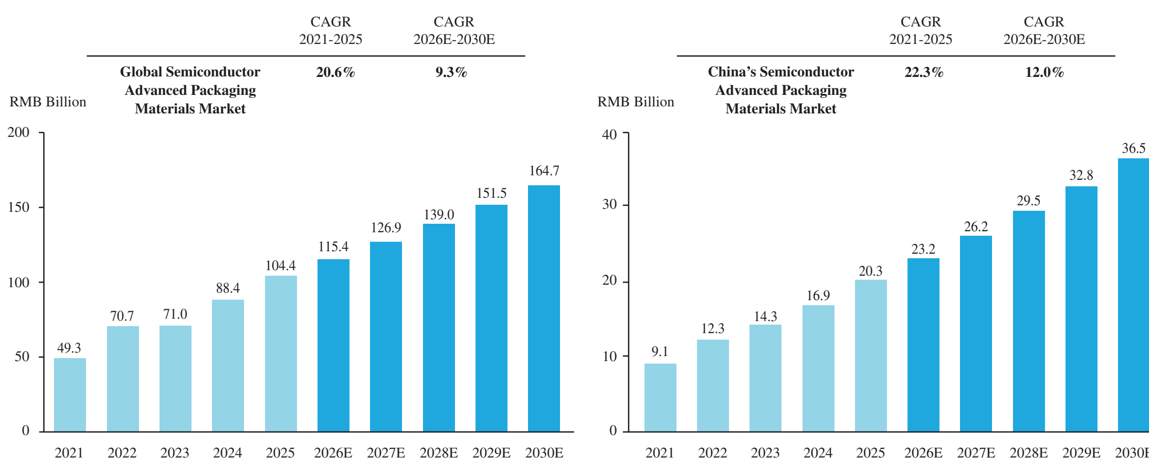
Note: China's market size includes sales by both domestic and international suppliers.

In semiconductor wafer fabrication lithography processes, in addition to wafer photoresists, wafer photoresist ancillary materials are also used to enable precise micro-pattern formation. The global wafer photoresist auxiliary materials market is expanding steadily alongside the continuous upgrades of semiconductor manufacturing processes. As an essential supporting material system in photolithography, photoresist auxiliary materials play a vital role in core steps including pattern transfer, wafer surface treatment and yield control, and are critical to improving pattern accuracy and process stability. With the continuous evolution of advanced processes, demand for high-performance photoresist auxiliary materials that are compatible with high-end photoresist systems and capable of meeting stricter requirements for precision and yield keeps growing. The global wafer photoresist ancillary materials market has grown from RMB14.7 billion in 2021 to RMB21.0 billion in 2025, and is expected to reach RMB32.9 billion by 2030. Meanwhile, the China market has increased from RMB3.2 billion in 2021 to RMB6.3 billion in 2025, and is projected to reach RMB12.0 billion by 2030.

Global and China's Semiconductor Advanced Packaging Materials Market

Advanced semiconductor packaging materials serve as the cornerstone for the application of Chiplet, 2.5D/3D and other sophisticated packaging technologies, mainly including packaging PI, TBA, underfill and high-density substrate materials. Driven by the growing demand for the computing power of chips, advanced packaging materials are expected to combine exceptional thermal stability, mechanical robustness and superior dielectric properties, so as to secure long-term reliability of high-density interconnect structures in complex application conditions. Spurred by surging demand from AI and high-performance computing, global and China's semiconductor advanced packaging materials markets are witnessing accelerated technological advancement alongside continuous growth. Driven by ongoing industrial upgrading, the China market is experiencing robust growth, with domestic manufacturers accelerating process innovation and large-scale commercialization. Going forward, supported by continued improvements in chip integration and deeper penetration across end-use sectors, the market is expected to present significant growth potential.

Market Size of Global and China's Semiconductor Advanced Packaging Materials, 2021–2030E



Source: *F&S*

Note: China's market size includes sales by both domestic and international suppliers.

Drivers and Development Trends of Global and China's Semiconductor Materials Industry

Rapid Expansion of Downstream High-tech Applications

In the integrated circuit sector, the boom in high-reliability and compute-intensive applications, such as AI, high-performance computing, data centers, and automotive electronics, is raising the bar for chip performance and integration. Accordingly, wafer manufacturing is evolving toward more sophisticated interconnect structures and more stacking layers, while the adoption of advanced packaging technologies imposes stricter requirements on the performance and stability of high-reliability advanced packaging materials. Meanwhile, CMP materials are being used with increasing frequency in multi-layer planarization processes, accompanied by significantly higher requirements for polishing efficiency, defect control, and process consistency. In addition, advanced photoresist materials and advanced packaging materials are playing an increasingly important role in fine pattern transfer, interconnect structure formation, and critical feature protection, driving a shift in core material demand from scale-driven growth to performance-driven advancement.

In the display panel sector, as end products keep evolving toward higher resolution, slimmer profiles and greater flexibility, production of foldable smartphones, wearable electronics and multi-form consumer devices is ramping up rapidly. Owing to its excellent flexibility, high-temperature resistance, and structural stability, YPI are gradually replacing traditional glass substrates and are widely adopted in flexible displays and foldable displays. Compared with traditional display materials, advanced display processes impose higher requirements on coating uniformity, long-term reliability, and process window compatibility, thereby driving semiconductor display materials toward higher performance and higher value-added development.

Continuous Support by Industrial Policies

Globally, the semiconductor and advanced display industries have been elevated by major economies to a strategic priority in national security and industrial competitiveness, with a series of systemic policy measures introduced to strengthen supply chain security and advanced manufacturing capabilities. For example, the US *CHIPS and Science Act* spurs the reshoring of domestic wafer manufacturing and advanced packaging capacity, while the EU *European Chips Act* strengthens capacity building and supply chain resilience within the region. China has defined integrated circuits and new-type displays as the key high-tech industries, prioritizing the coordinated development of wafer manufacturing, packaging and testing, new-type displays, and critical materials. The *Outline of the 15th Five-Year Plan for National Economic and Social Development of the People's Republic of China* calls for decisive breakthroughs in core technologies across key fields such as integrated circuits through synergy across the industrial chain. In addition, a series of supportive policies have been issued, including the *Several Policies for Promoting the High-Quality Development of Integrated Circuit and Software Industries in the New Era*, the *Action Plan for the Development of the Basic Electronic Components Industry (2021–2025)*, and the *Guiding Catalogue for Industrial Restructuring (2024)*. Policy orientation has gradually evolved from encouraging isolated breakthroughs to promoting systemic development, underpinning the long-term application of semiconductor materials across the value chain.

Technological Innovation and Upgrading of Semiconductor Materials

As advanced manufacturing processes, advanced packaging and new display technologies continue to evolve, the technical thresholds for semiconductor materials continue to rise, requiring a holistic approach in molecular design, formula optimization, and application validation to ensure high compatibility with core processes. Single materials or standalone technological breakthroughs can no longer support high-end manufacturing. Therefore, the industry is shifting toward a development model driven by the coordination of multi-technology platforms. Meanwhile, through machine learning and big data analytics, AI enables efficient molecular structure simulation, high-throughput formula screening, and process parameter prediction in the R&D process, profoundly reshaping the underlying R&D system and significantly shortening development cycles. Leveraging intelligent R&D systems and long-term technological accumulation in display and polymer materials, leading enterprises are expanding into high-end application fields such as semiconductor photoresists, packaging PI, and TBA. By integrating cross-category technology platforms, these companies can achieve synchronous validation of material performance and technology reuse, delivering scalable comprehensive solutions for downstream process upgrades and further building core competitiveness to support customers' technology iterations.

Entry Barriers of Global and China's Semiconductor Materials Industry

In terms of technological barriers, semiconductor materials involve multiple disciplines, including polymer synthesis, organic and inorganic materials, physical chemistry, and material application engineering, and involve exceptionally stringent standards in formula design, impurity control, material purification, and performance consistency. As the industry features rapid product iteration, substantial R&D investment, and lengthy verification cycles, new entrants find it hard to develop stable and mature advanced processes in a short term. In terms of industrialization barriers, the translation of laboratory research into large-scale commercialized products has to undergo a process from rigorous bench-scale testing and pilot-scale production to customer validation. This imposes high requirements on process design, equipment matching, factory construction, production engineering capabilities, and full-process monitoring systems, forming substantial thresholds in mass production and quality control. In terms of customer barriers, downstream wafer and panel manufacturers are highly sensitive to material stability and production yield. Due to long certification cycles and high supplier switching costs, customers prefer to establish long-term partnerships with mature suppliers, which makes it difficult for new entrants to acquire orders. In terms of talent barriers, the industry requires high-caliber interdisciplinary talents with expertise in materials science, chemistry, physics, and engineering as well as long-term practical experience. Building a mature and stable talent team in a short time is highly challenging for new entrants. In terms of fund barriers, continuous and substantial investment is required for R&D, production line construction, and quality system development, while the investment payback period is relatively long, creating a significant capital barrier for new entrants.

Competitive Landscape of Global and China's Semiconductor Materials Industry

In 2025, China's CMP materials market exhibits a high level of industry concentration, with the top five players collectively accounting for 71.5% of total market shares. In terms of revenue, the Company ranked third in the market with a 16.8% market share and ranked second among domestic suppliers. In China, the CMP Pads market is highly concentrated, with the top five players accounting for 95.1% in 2025. The industry exhibits a pronounced duopolistic structure, with the top two players together holding an 88.7% market share. In terms of revenue, the Company ranked second in the market with a 38.5% market share and ranked first among domestic suppliers.

Rankings in China's CMP Materials and CMP Pads Markets, by Revenue, 2025

CMP Materials				CMP Pads			
Rankings	Company name	Revenue in 2025	Market share	Rankings	Company name	Revenue in 2025	Market share
		RMB Billion				*RMB Billion*	
1	Company A	1.9	22.5%	1	Company B	1.4	50.2%
2	Company B	1.5	18.2%	**2**	**The Company**	**1.1**	**38.5%**
3	**The Company**	**1.4**	**16.8%**	3	Company E	0.1	2.5%
4	Company C	0.8	9.1%	4	Company F	0.1	2.1%
5	Company D	0.4	4.9%	5	Company C	0.1	1.8%
Top 5		**5.9**	**71.5%**	**Top 5**		**2.7**	**95.1%**
Total		**8.2**	**100.0%**	**Total**		**2.8**	**100.0%**

Source: Annual reports of listed companies, F&S

Notes:

1. Established in 2006 and headquartered in China, Company A is listed on the Shanghai Stock Exchange. It focuses on the R&D, production and sales of high-purity semiconductor materials for integrated circuit manufacturing, including CMP Slurry and functional wet electronic chemicals.

2. Established in 2025 and headquartered in the US, Company B is listed on the New York Stock Exchange. It specializes in the R&D, manufacturing and sales of high-performance materials for semiconductor manufacturing and advanced packaging. Its products cover CMP materials, advanced resins, thermal management materials and interconnect solutions.

3. Dating back to 1882 and headquartered in the US, Company C is listed on the New York Stock Exchange. It is engaged in the R&D, production and sales of semiconductor microelectronic materials, including high-end CMP Slurry and CMP Pads.

4. Dating back to 1934 and headquartered in Japan, Company D is listed on the Tokyo Stock Exchange. It spans fields such as healthcare, high-performance materials and imaging, with products covering high-end photoresists for semiconductors, CMP Slurry and functional films for advanced packaging.

5. Dating back to 1896 and headquartered in Japan, Company E is listed on the Tokyo Stock Exchange. It develops, manufactures and sells precision grinding materials, chemical products and textile goods, and supplies CMP Pads and associated precision processing consumables for wafer manufacturing.

6. Established in 2017 and headquartered in China, Company F specializes in the R&D, production and sales of materials for semiconductor integrated circuits and chips, including CMP Pads and supporting consumables.

In 2025, the top five suppliers of OLED coating-type functional materials in China accounted for a combined market share of 94.0%, indicating a high concentration in the market. In terms of revenue, the Company was the largest OLED coating-type functional materials provider in China in 2025, with a market share of 38.5%.

Rankings in China's OLED Coating-type Functional Materials Market, by Revenue, 2025

Rankings	Company name	Revenue in 2025	Market share
		RMB Billion	
1	**The Company**	**0.54**	**38.5%**
2	Company G	0.46	32.5%
3	Company H	0.13	9.2%
4	Company I	0.13	8.8%
5	Company J	0.07	5.0%
Top 5		**1.3**	**94.0%**
Total		**1.4**	**100.0%**

Source: Annual reports of listed companies, F&S

Notes:

1. Dating back to 1926 and headquartered in Japan, Company G is listed on the Tokyo Stock Exchange. It specializes in display materials, including coating-type optical films, polyimide films and packaging materials for flexible displays.

2. Founded in 1970 with headquarters in South Korea, Company H is listed on Korea Exchange. It is engaged in the production and sales of electronic materials for displays, including coating-type organic functional materials, packaging materials and quantum dot-related materials.

3. Established in 2017 and headquartered in China, Company I focuses on the R&D, manufacturing and sales of new-type electronic materials, including coating-type packaging adhesives and supporting functional materials used in display packaging.

4. Established in 2017 and headquartered in China, Company J develops, manufactures and sells high-performance electronic chemicals, including coating-type polyimide materials and supporting coating materials for flexible display basis materials.

Prices of the Core Raw Materials in the Semiconductor Materials Industry

The cost structure of semiconductor materials mainly consists of various functional materials, polymer materials and basic chemical materials, which are broadly used across semiconductor wafer manufacturing, packaging, and display panel manufacturing.

Overall, semiconductor materials involve a wide variety of raw materials with highly differentiated specifications, and differences in purity and performance grades result in a broad price range. In addition, the competitiveness of companies in the semiconductor materials industry is primarily driven by formulation technologies and material performance, and therefore fluctuations in raw material prices have a relatively limited impact on overall profitability.

OVERVIEW OF GLOBAL PRINTING & COPYING COMPATIBLE COLOR TONER INDUSTRY

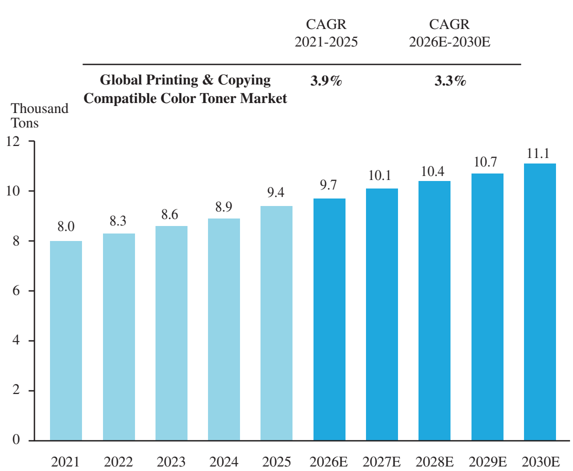
Introduction to the Global Printing & Copying Compatible Color Toner Industry

Printing & copying compatible color toner serves as a core imaging and developing consumable for laser printers, digital copiers and multifunction devices, widely applied in office printing, commercial graphic and text output and other scenarios. Unlike genuine consumables, compatible toner is typically compatible with printing equipment from multiple brands. Based on manufacturing processes, color toner is categorized into traditional pulverized toner and color polymerized toner ("**CPT**"). CPT is manufactured through chemical polymerization such as emulsion polymerization to form particles, followed by processes including dispersion, drying and classification. Compared with traditional pulverized toner, CPT features more regular particle shape and better-controlled particle size distribution, delivering better performance in transfer efficiency, image resolution and stable color reproduction. It also boasts advantages in low-temperature fusing, energy conservation and environmental protection. All this facilitates its gradual penetration into the high-end color printing and copying market.

Market Size of Global Printing & Copying Compatible Color Toner Industry

With the continued expansion of demand for color printing across commercial office, quick graphic printing, education, government and other sectors, the global printing & copying compatible color toner industry maintains steady growth. Meanwhile, end users' requirements for printing precision, image quality, and output stability continue to increase, driving ongoing optimization and upgrading of product structures and further expanding the market into mid-to-high-end application segments. Overall, supported by the steady release of downstream demand and continuous product mix upgrading, the global printing & copying compatible color toner market is expected to maintain a stable growth trend.

Market Size of Global Printing & Copying Compatible Color Toner Industry, by Sales Volume, 2021–2030E



Source: F&S

Competitive Landscape of Global Printing & Copying Compatible Color Toner Industry

In 2025, the global printing & copying compatible color toner industry recorded a total sales volume of approximately 9.4 thousand tons. The combined market share of the top five suppliers reached 69.4%, reflecting a relatively concentrated market. In 2025, the Company ranked first globally with a sales volume of 2.3 thousand tons and a 24.5% market share.

Rankings in Global Printing & Copying Compatible Color Toner Market by Sales Volume, 2025

Rankings	Company name	Sales volume in 2025	Market share
		1,000 tons	
1	**The Company**	**2.3**	**24.5%**
2	Company K	1.4	15.0%
3	Company L	1.2	12.8%
4	Company M	1.0	10.7%
5	Company N	0.6	6.4%
Top 5		**6.5**	**69.4%**
Total		**9.4**	**100.0%**

Source: Annual reports of listed companies, F&S

Notes:

1. Founded in 1982 and headquartered in Japan, Company K is engaged in the R&D, manufacturing and sales of toner for laser printers and copiers, remanufactured toner cartridges and related components.

2. Dating back to 1914 with the headquarters in Japan, Company L is listed on the Tokyo Stock Exchange. It specializes in the production, processing and sales of electrophotographic developers and printing, copying and recording materials, with product portfolios covering magnetic toner and full-color toner.

3. Established in 2011 and headquartered in China, Company M focuses on the R&D, manufacturing and sales of color toner for electrostatic copiers and laser printers.

4. Dating back to 1933 and headquartered in Japan, Company N is listed on the Tokyo Stock Exchange. Its core businesses cover high-performance materials and industrial materials, including OPC drums and toner for laser printers and copiers.

OVERVIEW OF GLOBAL LITHIUM BATTERY FUNCTIONAL AUXILIARY MATERIALS INDUSTRY

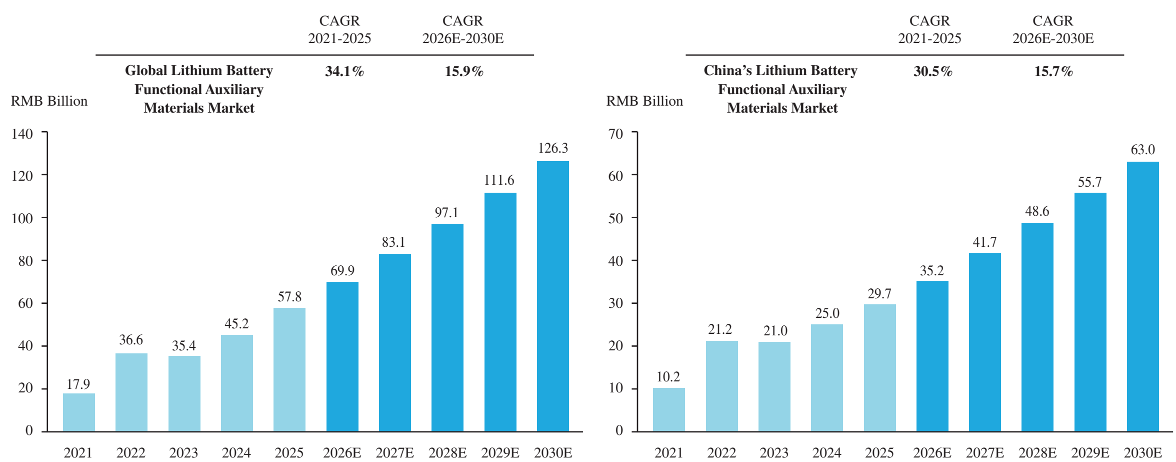
Introduction to the Lithium Battery Functional Auxiliary Materials Industry

Lithium battery materials primarily consist of: (i) four core materials, including cathode materials, anode materials, separators, and electrolytes; (ii) functional auxiliary materials. Lithium battery functional auxiliary materials constitute foundational materials underpinning the performance, safety and large-scale manufacturing of lithium batteries. They are the functional materials indispensable to lithium battery production, as well as an essential pillar for the high-quality development of the new energy industry. Lithium battery functional auxiliary materials primarily include dispersants, binders, and conductive agents. Specifically, dispersants are primarily used in cathode and anode slurry preparation. They improve the uniform dispersion of active materials and conductive agents and restrain particle agglomeration and sedimentation, thereby guaranteeing consistent electrode coating quality. Binders firmly bond active materials onto current collectors and enhance structural integrity and cycling durability of electrodes. Conductive agents are used to form conductive networks inside electrodes to boost electron transmission efficiency and optimize battery rate capability. With the advancements in semi-solid and solid-state battery technologies, emerging demands — such as the preparation of high solid-content electrode slurries and the interface compatibility between electrodes and electrolytes — are further driving the upgrading of auxiliary materials: Enhanced stability is required for dispersants, higher modulus and better interface compatibility for binders, and lower loading with highly conductive pathways for conductive agents. Driven by the booming new energy vehicle and energy storage sectors worldwide, lithium battery functional auxiliary materials are continuously evolving toward high performance, environmental friendliness and application-specific customization, forming a critical material system supporting large-scale production of high-end lithium batteries.

Market Size of Global and China's Lithium Battery Functional Auxiliary Materials

Global and China's functional auxiliary materials markets for lithium batteries are growing rapidly, driven primarily by the expanding demand from new energy vehicles, energy storage, consumer electronics and other downstream markets as well as the iteration of lithium batteries toward higher energy density, higher safety and longer lifecycle. Higher requirements are imposed on the formulation design, performance stability and process compatibility of dispersants, binders and conductive agents. In the future, with the continuous advancement of battery technologies and the ongoing expansion of application scenarios, lithium battery functional auxiliary materials are expected to continue upgrading toward higher performance, greater stability, and improved compatibility. The industry is expected to maintain growth, with significant market potential ahead.

Market Size of Global and China's Lithium Battery Functional Auxiliary Materials, 2021–2030E



Source: *F&S*

Note: Lithium battery functional auxiliary materials mainly include dispersants, binders and conductive agents.

Drivers and Development Trends of Global Lithium Battery Functional Auxiliary Materials Industry

Continuous Optimization of Material Systems and Manufacturing Processes

Centered on lithium batteries, the new energy technology pathway continuously drives the iteration of the lithium battery functional auxiliary materials through upgrades of material systems and manufacturing processes. As for the material systems, the ongoing improvements in the performance of cathode materials including high-nickel ternary, lithium iron phosphate and lithium manganese iron phosphate steer lithium batteries toward higher energy density, fast-charging capability and extended lifecycle. This imposes stricter requirements on functional auxiliaries such as dispersants, binders and conductive agents in terms of dispersion stability, binding strength, conductive efficiency and electrochemical stability, driving the continuous upgrades of auxiliary materials toward high performance and customization. On the manufacturing front, technological breakthroughs in electrode coating, winding/stacking processes, combined with the widespread deployment of automated and intelligent production lines, boost battery production efficiency and product yield, while driving the evolution of auxiliary materials toward higher consistency, lower impurity content and better compatibility with high-speed manufacturing workflows.

Expansion of End-Application Scenarios

The growing demand in end-use sectors including new energy vehicles, energy storage and consumer electronics becomes the core growth driver of the lithium battery functional auxiliary materials industry. In terms of power batteries, the increasing penetration of new energy vehicles worldwide accelerates the evolution of power batteries toward longer driving range, faster charging and enhanced safety, which further promotes the demand for high-performance dispersants, binders and conductive agents. In terms of energy storage, the expanding installed capacity of wind and photovoltaic power as well as the growing grid peak-shaving requirements are driving rapid growth in the energy storage market, spurring stronger demand for functional auxiliaries used in energy-storage lithium batteries. In terms of consumer electronics, end devices are increasingly slimmer with higher discharge rate and faster charging capability, pushing the upgrade of auxiliary materials toward refinement, superior performance and high compatibility.

Entry Barriers of the Global Lithium Battery Functional Auxiliary Materials Industry

Overall, the lithium battery functional auxiliary materials industry has high entry barriers. Specifically, in terms of technological barriers, the products involve multidisciplinary integration across polymer synthesis, electrochemistry and related fields, with stringent requirements on formulation design, impurity control and batch consistency. In addition, such products are required to maintain a high degree of compatibility with different battery chemistries and process conditions, resulting in relatively long product development and validation cycles. As a result, it is difficult for new entrants to quickly establish mature technologies and stable process capabilities. In terms of customer barriers, downstream battery manufacturers impose stringent requirements on material stability and safety, with lengthy supplier qualification cycles and relatively high switching costs once products are adopted, which typically leads to long-term and stable cooperation with established suppliers. In terms of capital barriers, the industry requires substantial and continuous investment in research and development, as well as production line construction, resulting in relatively high requirements on the financial strength of market participants.

Source

We have commissioned F&S to conduct research and prepare an F&S report on the global markets of semiconductor materials, printing & copying compatible color toner, as well as lithium battery functional auxiliary materials. Founded in New York in 1961, F&S is an independent global consultancy providing industry research and market strategy consulting services. We have signed an agreement with F&S, and paid F&S RMB500,000 for the preparation of the F&S Report.

To prepare the F&S Report, F&S conducted detailed preliminary research, including holding discussions with many leading industry participants and having interviews with relevant persons. F&S also conducted the secondary research, encompassing reviews of corporate reports, third-party independent research reports and data from its own research database. F&S estimated the total market size based on the historical analysis derived from macroeconomic data, while taking into account the key drivers of the above industries. Its market engineering forecasting methodology combines multiple forecasting techniques with a systematic approach based on market engineering measurement, relying on the analysts' expertise to consolidate the key market elements identified during the research stage. These elements include expert opinion forecasting methodologies, as well as the integration of market drivers and restraints, market challenges, market engineering measurement trends, and econometric variables.

The F&S Report was prepared based on the following assumptions: (i) the social, economic and political environments globally and in Chinese Mainland may remain stable over the forecast period; and (ii) core drivers of the above industries may boost market expansion during the forecast period.

Extracts from the F&S Report are incorporated herein and in other sections of this Document to provide potential investors with a holistic overview of the industry where we operate. Our Directors confirm that, to the best of their knowledge and following reasonable enquiries, since the release date of the F&S Report, there has been no material adverse change in the overall market information that would materially amend, contradict, or affect such information.