



**Kei Shimaji**  
Corporate Vice President  
General Manager, Electronic &  
Information Materials Division  
Toray Industries, Inc.

## TORAY IR Seminar

### Toray Group's Initiatives for Digital Innovation (DI) Business

The Group held an IR Seminar titled "Toray Group's Initiatives for Digital Innovation (DI) Business" on September 13, 2024. During the event, presentations were provided by three persons: Kei Shimaji, Corporate Vice President and General Manager of the Electronic & Information Materials Division; Yuichiro Iguchi, Corporate Vice President and General Manager of the Research Division on behalf of the Company; Kenji Sato, Director, Vice President of Toray Engineering Co., Ltd.

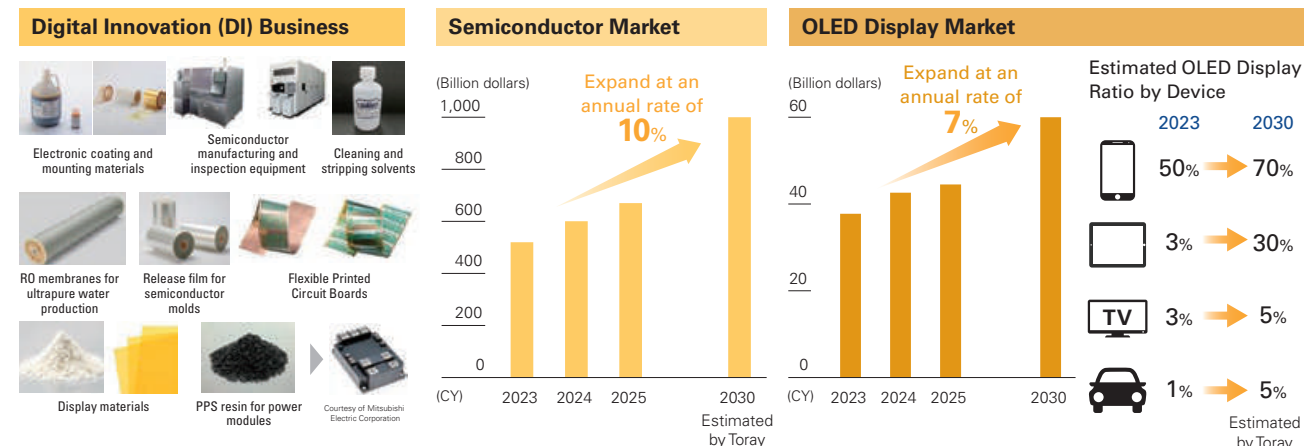
### Outline of the DI Business

#### Targeting ¥250 Billion in Revenue with a Focus on Semiconductor and Display Applications

Under Medium-Term Management Program "Project AP-G 2025," the Group has positioned the Sustainability Innovation (SI) business and the Digital Innovation (DI) business as growth areas in which it can leverage its strengths, and we aim to expand revenue from each business to account for around 60% of consolidated revenue. Of these two businesses, the DI business is defined as "materials, equipment, technologies, and services that help improve convenience and productivity by supporting the widespread adoption of digital technology." Typical products from this business include electronic coating and packaging materials, semiconductor manufacturing and

inspection equipment, chemical products, resins, films, and printed circuit boards.

Within DI-related fields, the semiconductor market is expanding in step with ICT-related product growth, while the widespread use of smart devices is driving demand upwards, leading to expectations for a continued high annual growth rate of 10%. Moreover, with the rise to prominence of OLED displays on the display market and increasing adoption for use in tablets and laptop PCs beyond just smartphones and TVs, this area is expected to achieve an annual growth rate of 7%. By steadily capturing this expanding demand, the Group aims to achieve revenue of ¥250 billion in FY 2025.



### Basic Strategy of the DI Business

#### Providing Solutions That Leverage the Collective Strengths of the Toray Group

The Toray Group leverages the core technology such as Material Design (materials), Engineering Capabilities (equipment and processing technology), and Advanced Analytical Capabilities technologies in an effort to help enhance the performance and efficiency, as well as environmental-friendliness, of semiconductors, electronic components, and displays in the fields of micro-patterning, coating, and distributed substance control.

By pursuing these technologies to the greatest extent possible, the Group goes beyond simply expanding the materials and parts businesses to connect these efforts to the commercialization of manufacturing and inspection equipment, as well as analysis services.

Recognizing the potential of this wide range of technologies as our collective strengths, the Toray Group has placed the

provision of total solutions at the very center of the DI business. Yet the Group intends to do more than simply provide products and services that align with the needs of customers in the materials, equipment, and analysis fields. Accordingly, we will engage with customers in a variety of ways to provide total solutions in hopes of contributing to creation of innovation.

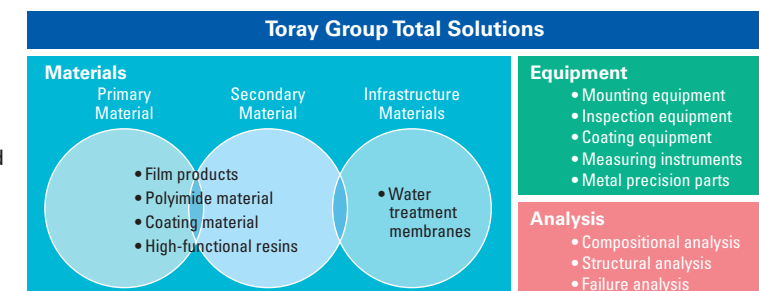
For example, in addition to coordinating materials and parts, manufacturing and inspection equipment, and analysis services to develop actual materials, we rapidly implement a cycle that incorporates the stages involved in the details of customer improvement requests, namely analyzing mechanisms, identifying optimal manufacturing conditions, and proposing improved products, thereby setting ourselves apart from competitors. Moreover, we propose solutions that encompass materials, process conditions, and equipment to emerging manufacturers who have newly entered a business field. Similarly, with regard to manufacturing

micro-LED displays that we expect progress toward commercialization and business expansion in the future, we propose and provide solutions that combine materials, equipment, and analysis services for each process, from chip manufacturing to pitch transformation, bonding, defective area repair, and panel assembly. We also expect to see the micro-chip transfer and bonding technology used here to play a role in optoelectronic fusion device processes.

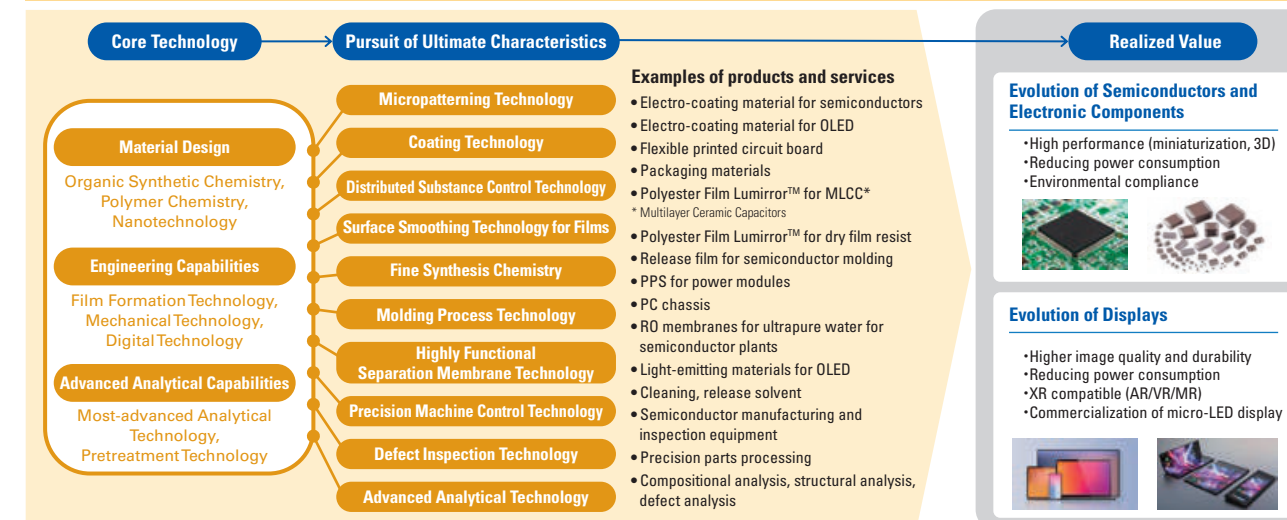
The manufacturing and development bases of major semiconductor, electronic component, and display manufacturers are clustered in the East Asian region, where the Toray Group also operates several research, technology, production, customer service, and marketing bases. Meanwhile, the Toray Group has also established bases to service product planning and design teams at its customers in the U.S. and Europe.

### Group-wide Policies Leveraging Toray Group's Combined Strength

- Materials:** Propose high-performance materials with added value that suit customer needs
- Equipment:** Provide all-around packaging, inspection and measurement equipment that offers precision, speed and performance
- Analysis:** Provide various analysis using optimum analytical technologies, developed based on identified needs



### Expansion of Core Technology into the DI Area



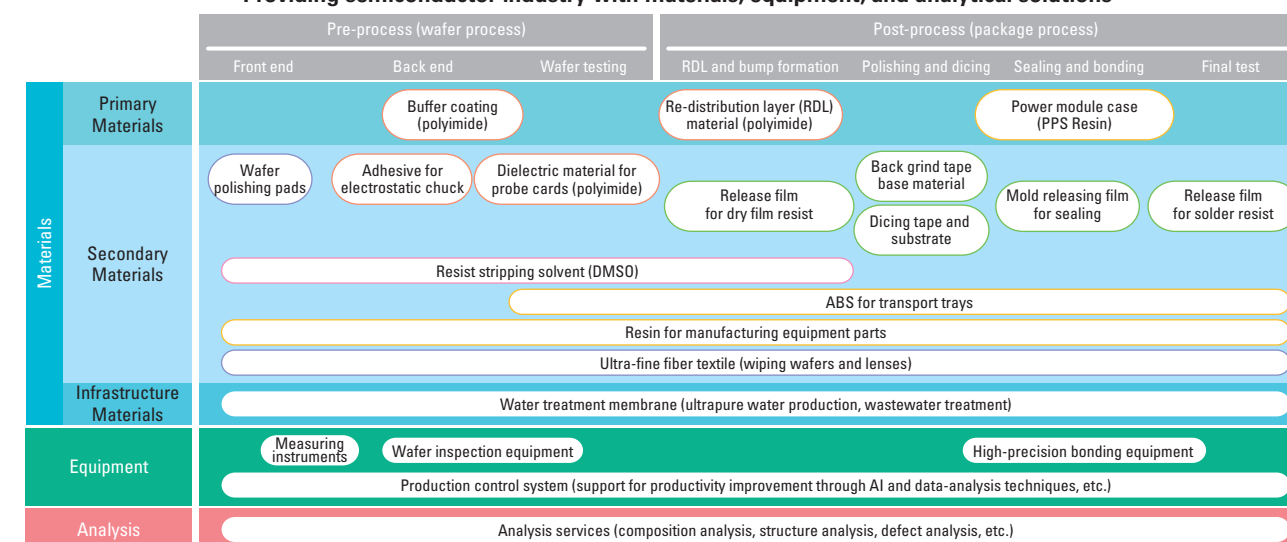
### Mainstay Products and Future Prospects

#### Development in the Semiconductor Field

Our semiconductor-related products cover wide range, from primary materials used in semiconductors themselves, such as buffer coatings and resins, to secondary materials, including films, chemicals, and resin products. In this way, Toray Group products are broadly adopted across the pre-process

and post-process. Similarly, Toray Engineering, whose manufacturing and inspection equipment is also used in each process, provides production control systems in addition to water treatment membranes and analysis services in the semiconductor manufacturing infrastructure field.

### Providing semiconductor industry with materials, equipment, and analytical solutions





Main Products in the Semiconductor Field

[Materials] Power Semiconductors: Polyimide Insulation Materials

Used for power control and conversion, the market for power semiconductors is expected to achieve an average annual growth rate of 10% owing to the expanding demand for renewable energy and initiatives to increase power efficiency. Toray provides this market with insulation materials that leverage its polyimide resin design technology. These materials have achieved one of the highest shares of the market by offering high reliability in terms of heat resistance, mechanical properties, and chemical resistance. This high market share also reflects our diverse product lineup that corresponds to customer processes. Going forward, we will ensure all products are free of NMP and PFAS in compliance with environmental regulations in aims of further expanding market share.

[Materials] Dry Film Resist (DFR) Film

Used to form printed circuit boards on semiconductors, DFR films are expected to achieve an average annual growth rate of 10% against the backdrop of increasing demand for quality improvements coinciding with finer pitch wiring. Toray has put in place a production system that spans China and Southeast Asia, possesses strengths in advanced film surface design technology and quality control, and boasts the largest share of the high-end market. Going forward, we will promote the appeal of our surface design and advanced quality control capabilities intended to satisfy finer pitch wiring applications, and contribute to greater customer yields and product value in aims of expanding sales more broadly over the high-end and mid-range markets.

[Materials] Stripping Solution/Cleaning Solution DMSO (Dimethyl sulfoxide)

As the primary raw material used in semiconductor resist stripping and cleaning solutions, DMSO is expected to achieve an average annual growth rate of 7% thanks to an expanding semiconductor market and stricter impurity (metal) management. As the only manufacturer of DMSO in Japan, the Toray Group operates production sites in Japan and China, possesses

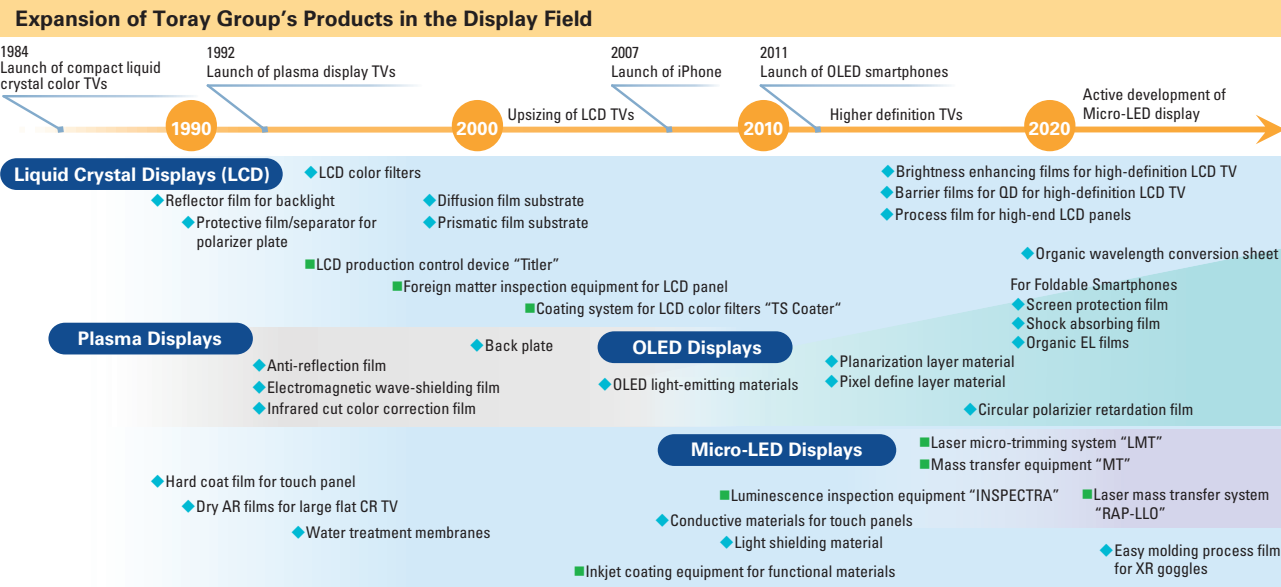
world-class impurity management and analytical capabilities, and boasts the top share of the semiconductor market. Going forward, we will increase production output and deepen global supply operations, as well as promote recycling to help reduce environmental impacts with a focus on capturing replacement demand for NMP and other regulated solvents.

[Materials] Films for Multilayer Ceramic Capacitors (MLCC)

MLCC are used in smartphones, new energy vehicles, AI servers, and a wide range of other applications, and are expected to grow at an average annual rate of 6%. In addition to smoothness and surface design technology in the area of MLCC release films, Toray's strengths lie in its production technology that realizes high-quality products with superior thickness uniformity without contamination or scratches. Buoyed by a global production network, the Toray Group boasts the top share in this application. With production sites in Japan, South Korea, and Malaysia, the Group will address further growth in demand, and plans to commission new film production facilities at the Gifu Plant in Japan in 2025. Moreover, we developed the recycled PET film Ecouse™ Lumirror™, and realized the world's first commercial-level circulatory recycling system for high-end films.

Expansion in the Display Field

The display field got its start with the launch of compact liquid crystal color televisions in 1984 and plasma display televisions in 1992, since which time flat screen televisions have grown in size. Following the emergence of the first-generation iPhone in 2007, smartphones equipped with OLED displays hit the market in 2011. Throughout this history, the Toray Group has developed various products ranging from materials to manufacturing equipment, which it has supplied through mass production. More recently, this market has expanded with the replacement of small- and medium-sized liquid crystal displays with OLED displays, whereas the development of micro-LED displays as a next-generation display candidate has been active.



Main Products in the Display Field

[Materials] Polyimide for OLED Displays

The OLED display market is expanding through higher sales of smartphones and new applications for tablet and laptop PCs, and is expected to grow at an average annual rate of 7%. Toray's polyimide for OLED displays has become the industry standard for pixel separation layer and planarization layer applications, and has an overwhelming track record in mass

production. Having contributed to higher display quality (high reliability) and manufacturing process simplification (cost reduction), they have attained the largest share of the market. Going forward, we will advance proposals that address foldable displays and higher brightness, as well as for products that comply with environmental regulations. Also, we will apply intellectual property and other strategies to solidify this material's position as the continued industry standard.

Overview of the Semiconductor Inspection Equipment Business



Kenji Sato  
Toray Engineering Co., Ltd.  
Director, Vice President, Mechatronics & Fine Technology Business Div., President, TASMIT, Inc.

Growth of Electron Beam and Optical Wafer Inspection Equipment

Semiconductors are categorized into logic, memory, and other types, and the semiconductor shipment value combined is expected to reach ¥100 trillion on a global basis in 2030. Against this backdrop, TASMIT, Inc., provides electron beam and optical wafer inspection equipment.

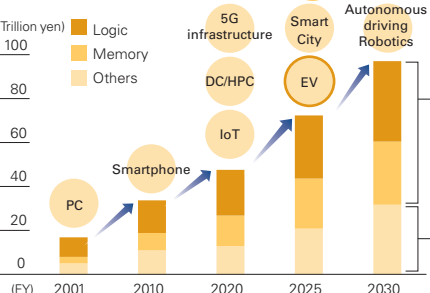
Electron beam wafer inspection and measurement equipment (NGR™) is used in the logic and memory field, where this type's strengths lie in technologies that can measure complex

two-dimensional patterns at high-speed and with high-precision by comparing design data to nanometer level images taken at a wide field and low distortion. We plan to expand this business with a focus on advanced semiconductors for AI and other areas.

The optical wafer inspection equipment (INSPECTRA™) is primarily used in other semiconductor markets, with strengths in high-speed, high-precision inspection based on a proprietary quality product learning algorithm and an advanced defect detection technology. INSPECTRA™ has a particularly high share of the domestic automotive power semiconductor market. This system is expected to help fully eliminate the output of defects by conducting 100% inspection utilizing its high-speed, high-precision inspection capability, and we intend to expand the business for overseas markets.

As a member of the Toray Group, Toray Engineering aims to drive innovation by leveraging the three combined strengths of materials, equipment, and analysis for semiconductors.

Semiconductor Shipment Value Trends (Forecast)



Source: Compiled by the Ministry of Economy, Trade, and Industry, using data from Omdia, SEMI, TrendForce, Fuji Keizai Co., Ltd., Global Net Corp., and various company financial reports.  
(\*Figures: as of 2019, exchange rate: 1 USD = 110 yen, 1 euro = 125 yen)

Overview of Inspection and Measurement Equipment Business

NGR	
Business scale	FY 2023 Performance: Revenue 3.0 billion yen
Features	Contributing to the development of cutting-edge semiconductors with a wide, low-distortion field of view and Die to Database technology.
Market	Aiming to expand adoption in various processes, not only development but also mass production, in factories for advanced semiconductors.
Key areas	Advanced semiconductors (logic IC, DRAM)
INSPECTRA	
Business scale	FY 2023 performance: Revenue 5.9 billion yen <b>Top share in Japan</b>
Features	Enables full inspection with the world's fastest throughput.
Market	High market share in Japan. Working to expand overseas business by operating demo centers in various overseas locations.
Key areas	Power semiconductors for vehicles, µLED, communication filters

R&D of Toray Group's Digital Innovation (DI) Business



Yuichiro Iguchi  
Corporate Vice President  
General Manager of Research Division, Toray Industries, Inc.

Toray has positioned semiconductor infrastructure-related products, semiconductor film-related products, and optoelectronic fusion-related products as the R&D priority areas for the DI business. From a semiconductor infrastructure-related perspective, in addition to RO membranes, air filter material, and filter material for resist as technologies for enhancing the purity of water, air, and chemicals, we also possess gas recovery and recycling technology with which we aim to help improve yields and quality, and contribute to environmental-friendliness.

For semiconductor film-related products, we are particularly focused on deploying release films for semiconductor molds. As these products suppress mold contamination and mitigate problems with film breakage and wrinkle transfer, they are adopted on a large scale as a means of helping to improve the operation rates and yields of semiconductor sealing processes.

In the optoelectronic fusion-related field, amid expectations for lower power consumption enabled by use of optical wiring for high-capacity, high-speed communications, we propose processes that package light emitting elements on optical waveguides at high-speed and high-precision by combining Toray's transfer materials and Toray Engineering's high-speed laser transfer equipment. Moreover, with respect to multi-core optical fibers used for high-capacity communications exceeding 100 Gbps, we are leveraging the composite spinneret technology acquired through the fiber business to develop a technology that forms plastic optical fibers with multiple cores in a single pass.

R&D Priority Areas in DI Business

