### Financial Results Q3 FY24/3



Make Wave, Make World.

世界が知らない世界をつくれ

### **Executive Summary**

# FY24/3 Q3 results are on track to FY target

- In a joint development with Mitsui Chemicals to establish an innovative eco-friendly carbon fiber production technology, we have constructed the demonstration facility within Mitsui Chemicals' Nagoya Works in December 2023. Received total JPY768MM as a consideration.
- As a result, Q3 sales reached JPY1,270MM (+113.6% YoY).
- 68.8% progress rate for FY24/3 plan (JPY1,846MM)
- Progress rate on contract basis reached 97.1% (JPY1,792MM). We do not change the sales forecast in consideration of uncertainties in development.

### Steady progress made in KPI:

- (1) # of new contracts
- (2) # of total contracts
- (3) sales by phase

- Acquired 23 new contracts, <u>82.1% progress</u> of FY24/3 target (28 contracts).
- Total 58 contracts signed, 89.2% progress of FY24/3 target (65 contracts).
- Sales from Phase 2 contracts exceeded JPY1.2Bn.

### Advancement in green business

- Construction of a demonstration facility of innovative carbon fiber production technology (Mitsui Chemicals, Inc.)
- Joint development of small-scale distributed chemical recycling system using microwave heating (Yokogawa Solution Service Corporation)
- Microwave reduction of iron ore on a laboratory scale (Internal R&D)
- Joint development of transparent conductive film with high transparency and conductivity (Dai Nippon Printing Co., Ltd.)



#### Presenters



#### Iwao Yoshino, President and CEO

- After working at Mitsui & Co., Ltd. (Chemicals Division), he engaged in a startup company and a consulting firm in the United States.
- Graduated from Keio University Faculty of Law in 1990, graduated from UC Berkeley MBA in 2002, and was a Hitachi Fellow in Management of Technology (MOT).



#### Nao Ikemoto, Director of Finance & Investor Relation

- After working at M&A Advisory Group of Morgan Stanley, he engaged in management of a biotechnology startup and joined MWCC in 2023.
- Graduated from the School of Engineering at the University of Tokyo in 2015.



### Agenda

- 1. Company Overview
- 2. Financial Results and KPI Highlights
- 3. Topics
- 4. Appendix



#### [Mission]

# Make Wave, Make World [Vision]

Innovate chemical industry, which has been left unchanged for more than a century, and revolutionize the world of manufacturing



### **Company Overview**



Name

Microwave Chemical Co., Ltd.

Founded

August 15, 2007

Representative

Iwao Yoshino, CEO

# of Employees

64 (including 13 Ph.D.)<sup>(1)</sup>

**Head Office** 

Photonics Center 5F, 2-1 Yamadaoka, Suita, 565-0871 Osaka

**Business** 

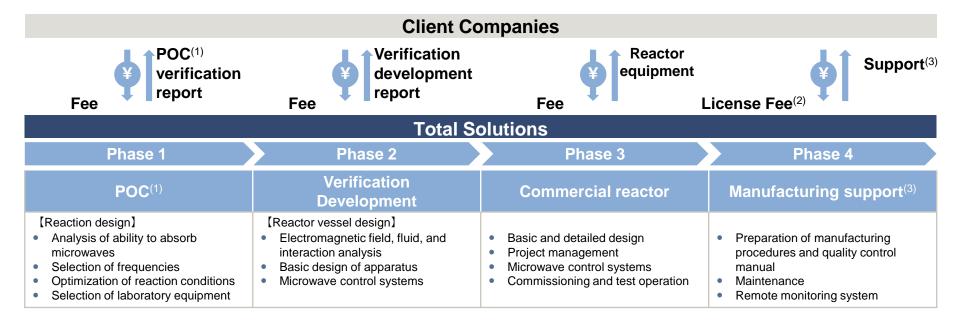
Provide R&D and engineering solutions for clients based on our microwave technology platform

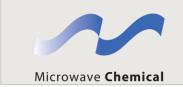
(1) As of March 31, 2023



#### **Business Model**

- (1) Provide total solutions from R&D to engineering
- (2) Realize profit on each phase and license fee when commercialized by our clients





#### **Technology Platform**

**Development Team (Scientists and Engineers)** 

**Development Infrastructure (Laboratories, Pilot facilities and Calculators)** 

#### Notes:

- (1) POC: Proof of Concept. The process of testing the feasibility and effectiveness of new concept or idea before actual development
- (2) License: Share the client value earned by introduction of microwave process as license fees. Specifically, receive as upfront payment and recurring royalties
- (3) Manufacturing support and maintenance: Support clients who have installed microwave reactors in their manufacturing process. In addition, provide maintenance of microwave reactors and other facilities



### **Growth Strategy**

Focus and advance investment for growth from FY25/3 onwards.

#### **Business Model**



#### **Focus Areas**

# of Contracts



**Unit Price** 



Project Phase Development



Packaged Solution

- 1 Acquisition of high-quality contracts
  - Targeting # of new contracts to be comparable to that in FY23/3.
  - Rather than simply pursuing quantity, will focus on high-quality inquiries that lead to large-scale projects.
- 2 Enhance certainty of project phase development by strengthening technology platform
  - Improvement of efficiency and profitability by strengthening our technology platforms focusing on areas with technological superiority and market demand.
- Standardization
  - Acceleration of existing standardization procedures (e.g. chemical recycling, freezedrying) and launch of new standardized business

- 4 Focus on growth areas
  - · Form projects on green business area.
  - Accelerate growth by active investments in the carbon-neutral field.

#### Green business

Healthcare (drug, food, etc.)

Electronics (electronic materials)



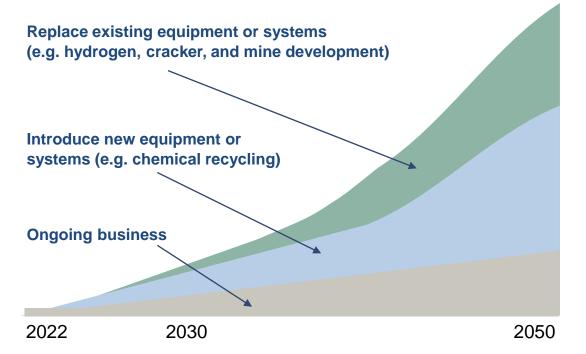


#### Our Vision toward Carbon Neutral

We will expand our business by committing to carbon neutrality of various industries.

#### **Our Growth Image**

- For heavy industries, average lifetimes of plant equipment is around 40 years, and 30% of existing assets are expected to be renovated within the next 10 years.<sup>(1)</sup>
- Generally, it takes c.10 years for new technologies to become commercially viable. In order to achieve carbon neutral, we need to start development "now".



#### **Active Solutions for Decarbonization**

- Electrification of the chemical industry
  - Electrification of crackers
  - Other processes
- Energy
  - Turquoise hydrogen
  - Ammonia
  - Nuclear fusion
- Raw materials
  - Chemical recycling
  - Biomass
- Carbon Fixation
  - CCUS
- Mobility
  - Battery-related material (cathode, etc.)
  - Carbon Fiber/CFRP
  - Lithium and rare earth (mining process)

(1) Net Zero by 2050 A Road Map for the Global Energy Sector IEA May 2021



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### FY24/3 Budget & FY23/3 Results

Net sales target JPY1,846MM, operating profit JPY40MM.

(JPYMM)

	FY23/3 Full-year (result)	FY24/3 Full-year (budget)	YoY o	comparison
Net sales  Phase 1 Phase 2 Phase 3 Phase 4 Others	1,215 567 593 35 - 19	1,846 559 1,284 - - 3	+631 (8) +690 (35) - (16)	+51.9% (1.4)% +116.3% (100)% - (84.4)%
Operating profit	59	40	(19)	(32.0)%
Ordinary profit	26	33	+7	+27.8%
Net Profit	75	89	+14	+18.9%

<sup>\*</sup>The estimated amount of corporate tax adjustment is zero yen.



#### Financial Results for FY24/3 Q3

Sales in Q3 landed at +113.6% compared to the same period of the previous year.

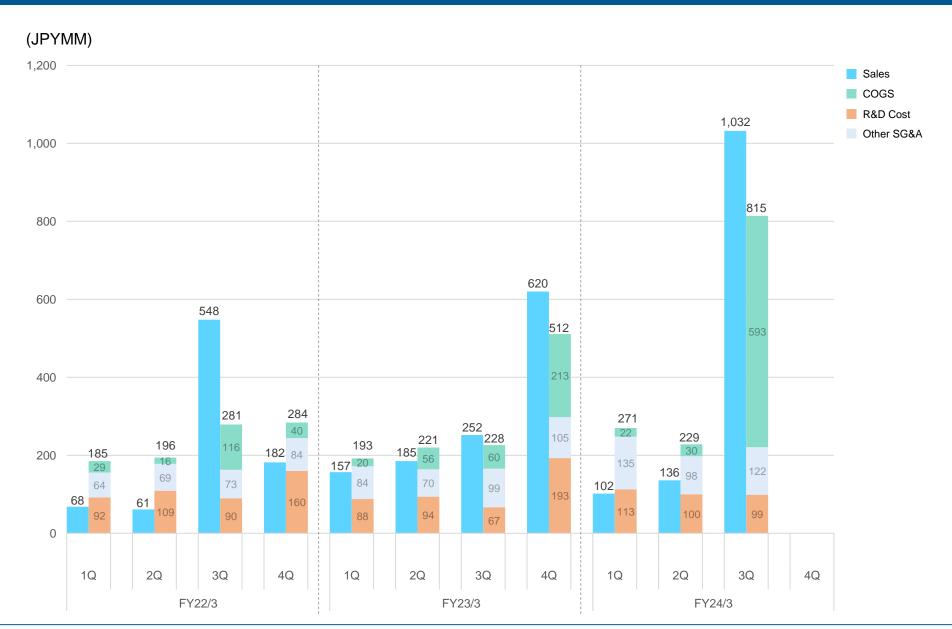
(JPYMM)

	FY23/3 Q3 total	FY24/3 Q3 total	YoY comparison	
Net sales  Phase 1 Phase 2 Phase 3 Phase 4 Others	594 350 209 35 - 0	1,270 301 968 - - -	+675 (48) +759 (35) - (0)	+113.6% (13.8)% +362.9% (100)% - (100)% <sup>(1)</sup>
Operating profit	(47)	(45)	+2	-
Ordinary profit	(81)	(47)	+33	-
Net Profit	(96)	(73)	+23	-

<sup>(1)</sup> As FY23/3Q3 sales were less than JPY1MM and FY24/3Q3 sales were zero, YoY comparison is (100)%.



### Quarterly Sales and Costs (FY22/3Q1-FY24/3Q3)

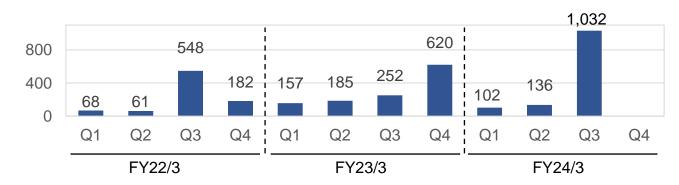


### Seasonal Fluctuations / Revenue Recognition

#### **Seasonal Fluctuations**

- Our major clients, chemical companies, finalizes budgets by March, just before the start of the new fiscal year, so
  projects with MWCC often begin in the first or second quarter. As a result, the completion of the contracts, in which
  our company's revenues are recorded, tends to be biased toward the second half of the year. There is also an
  impact from the completion timing of large-scale projects.
- In addition, as the majority of SG&A expenses are fixed costs, the proportion of profits also tends to be weighted toward the second half of the year, which would affect investors' decisions.

### Quarterly Net Sales (JPYMM)



#### **Revenue Recognition**

The following is a description of the main performance obligations in the Company's main business related to revenues arising from contracts with clients and the usual time at which such performance obligations are met. Payment is made generally within one month after obligation is fulfilled and dose not include financial component.

#### (1) Joint development agreement(JDA)

The Company submits reports, samples, etc. stipulated in the JDA and receives payment. Under such agreements, revenue is booked upon acceptance of the report, samples, etc. by the client.

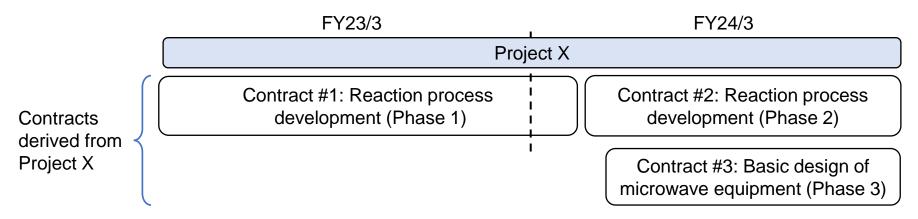
#### (2) License agreement

Under license agreements, the Company licenses its intellectual property to clients and receives upfront payments and running royalties as compensation. The upfront payment is booked as revenue at the time the intellectual property is licensed. Running royalties are based on the sales revenue of the licensee company, and revenue is recognized when the product is sold by the licensee company.



### KPI (Key Performance Indicator)

- Important KPIs for our business are (1) number of new contracts, (2) total number of contracts, and (3) sales by phase.
  - Contracts are executed with clients based on our solutions and service per phase.
  - Multiple contracts would be executed with one project as indicated below.
- (3) Sales by phase shows progress of the contracts by sales in each phase  $(1\sim4)$ .
- Contracts are basis of our sales. We disclose number of contracts which are expected to be completed and book sales within this FY.



#### (Reference)

- Number of projects: Project consists of a team with tasks to provide "total solution" to clients. It is also referred as a pipeline and categorized in two types:
  - Revenue-related projects, where we provide solutions to clients
  - Revenue-unrelated projects, where we invest our own resources for internal R&D



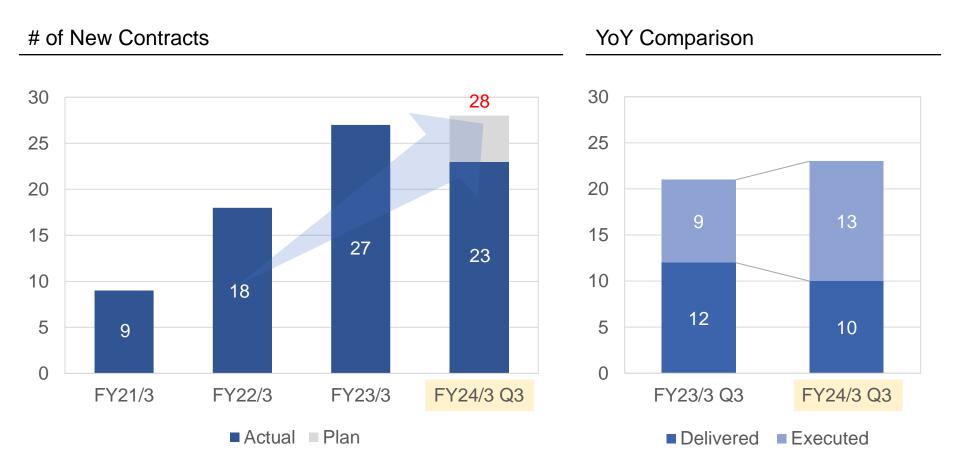
### FY24/3 Q3 KPI Highlights

- 1 Number of New Contracts
- Acquired 23 contracts out of 28 annual target.
- **2 Total Number of Contracts**
- 58 contracts were executed and 33 delivered (FY24/3 target is 65 contracts).
- 3 Sales by Phase
- JPY1,792MM (97.1%) achieved on contract basis (FY24/3 target JPY1,846MM).
- 4 (Ref.) Number of Projects
- 50 solution provide projects and 3 R&D projects are ongoing.



### KPI (1) Number of New Contracts

Acquired 23 new contracts in Q3, out of 28 annual target (21 contracts in FY23/3Q3).

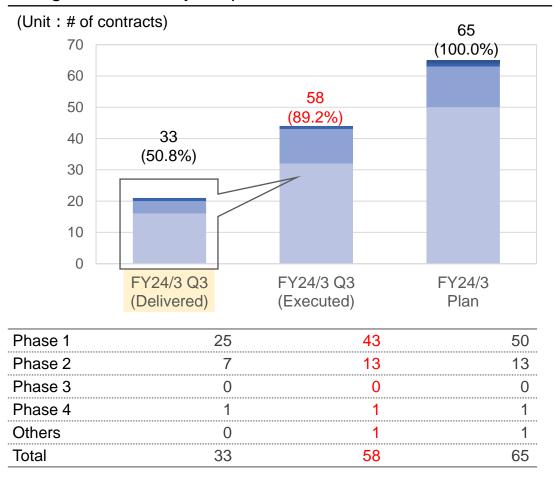




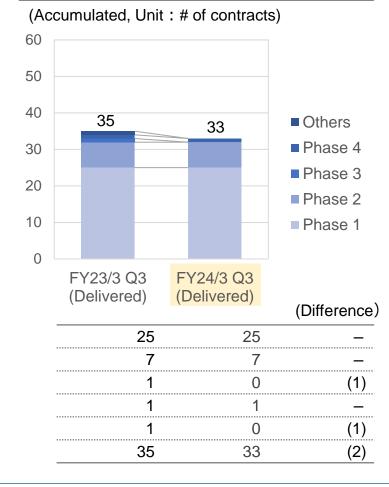
### KPI (2) Total Number of Contracts

89.2% progress for FY24/3 target.

#### Progress vs. Full-year plan



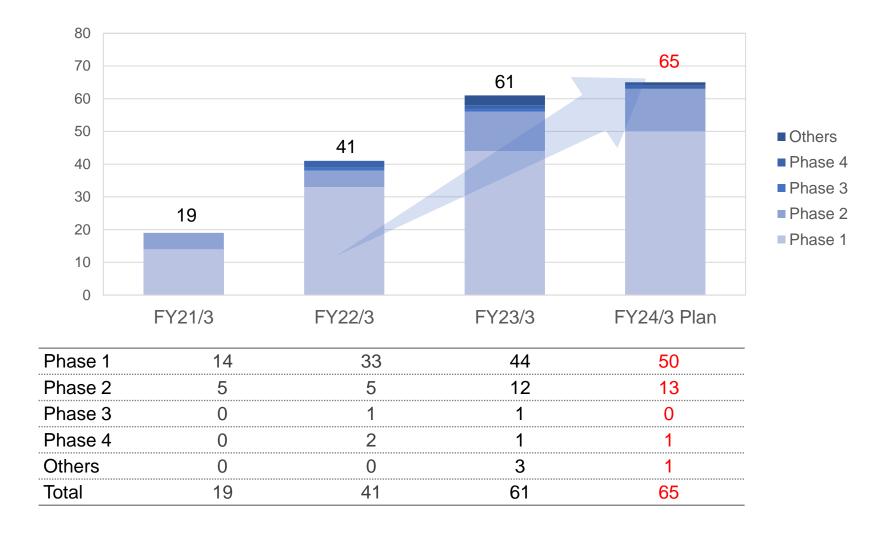
#### YoY Comparison





#### (Ref) Total Number of Contracts: Actuals & FY24/3 Plan

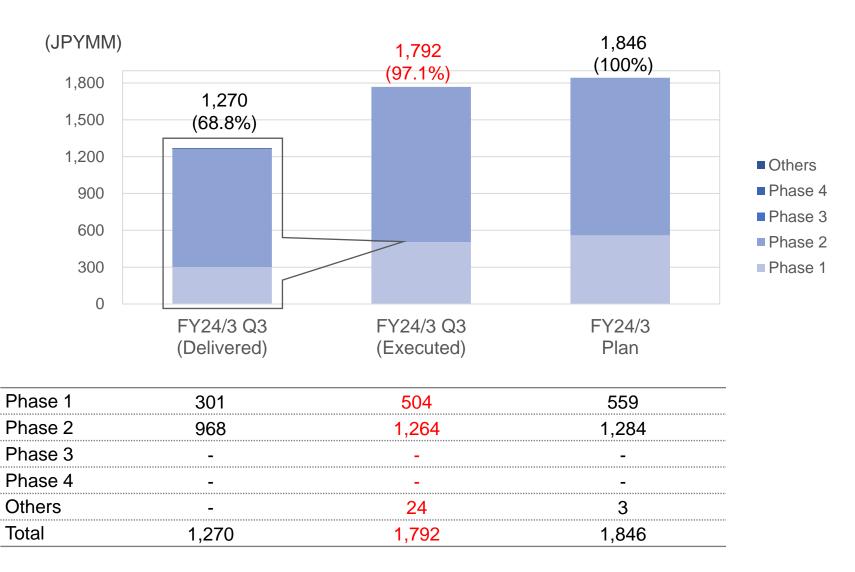
Expect similar number of contracts for FY24/3 compared to FY23/3.





### KPI (3) Sales by Phase

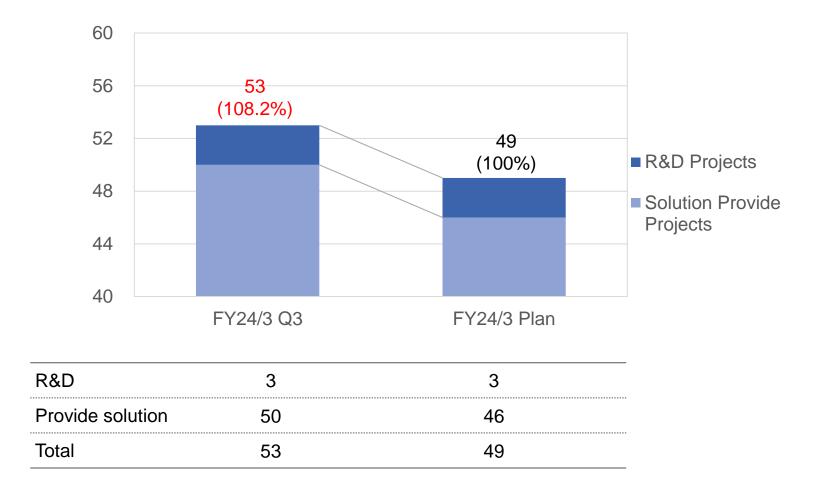
Steady progress made in each phase on contract basis.





### (Ref) Total Number of Projects

Achieved full-year plan.





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### Topics: Q3 Business Highlight

Carbon Fiber  Focus on Green business Chemical Recycling		<ul> <li>Construction of a demonstration facility for innovative carbon fiber production technology at Mitsui Chemicals' Nagoya Works</li> <li>Partner: Mitsui Chemicals, Inc.</li> <li>Date of announcement: February 8, 2024</li> </ul>
		<ul> <li>Joint development of small-scale distributed chemical recycling system using microwave heating</li> <li>Partner: Yokogawa Solution Service Corporation</li> <li>Announcement date: October 31, 2023</li> </ul>
	Mining Process	<ul> <li>Microwave reduction of iron ore on a laboratory scale</li> <li>Internal R&amp;D</li> <li>Announcement date: December 13, 2023</li> </ul>
Electronics	New Materials	<ul> <li>Joint development of transparent conductive film with high transparency and conductivity</li> <li>Partner: Dai Nippon Printing Co., Ltd.</li> <li>Announcement date: October 3, 2023</li> </ul>



## Construction of demonstration facility for innovative carbon fiber production at Mitsui Chemicals' Nagoya Works

- We have completed construction of a demonstration facility for innovative carbon fiber (CF) production technology at Mitsui Chemicals' Nagoya works in December 2023.
- We provided all the necessary equipment for a heating line based on Carbon-MX<sup>™</sup> technology, which combines the oxidation process with the carbonization process.
  - Compared to conventional methods, the heating time is significantly shortened, and the equipment size becomes more compact.
  - As the temperature of the equipment would not be high, there are advantages in terms of equipment cost, energy consumption (c.50% reduction), and safety.

By switching to renewable energy sources for microwaves generation, CO<sub>2</sub> emissions are

expected to reduced by more than 90%.

 After the completion, trial operations have already started in January 2024, and we study to establish a mass production technology, aiming to start supplying CF samples by the end of FY2024.



**Demonstration facility** 

#### Joint development of small-scale distributed chemical recycling system

- Yokogawa Solution Service and Microwave Chemical have concluded an agreement for the joint development of a small-scale distributed chemical recycling (CR) system to break down and process discarded plastic near where it is generated.
  - We have developed core apparatus for the CR system, which incorporates continuous thermal decomposition functions for polyethylene, polypropylene, and polystyrene.
  - Yokogawa Solution Service will investigate measurement methods for monitoring the state of the thermal decomposition process and performing component analysis and estimation in real time.
- We will continue prototyping to incorporate user needs and further refine functions and specifications to commercialize a small-scale, high-efficiency recycling system.

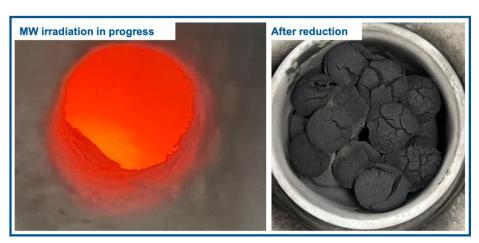


The bench plant used for verification and testing



#### Microwave reduction of iron ore on a laboratory scale

- The steel industry is estimated to account for c.10% of global CO<sub>2</sub> emissions. The blast furnace method particularly emits a large amount of CO<sub>2</sub> during the coal reduction process.
- Iron ore and coal, used as a reducing agent, readily absorb microwaves, allowing direct heating and reducing energy consumption and CO<sub>2</sub> emissions.
- Scale-up has been a challenge up to now, but by using our technology platform "Green Mining-MX", we have succeeded in reducing iron ore on a laboratory scale, which is a foothold for scale-up.
- By 2025, we will conduct demonstration tests using our standard bench-scale equipment to establish the technology while seeking partner companies.

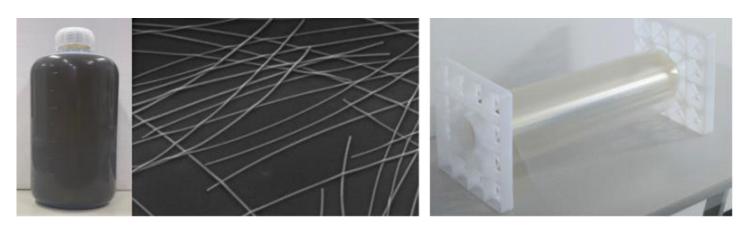


Microwave reduction of iron ore in our laboratory



#### Joint development of new transparent conductive film with Dai Nippon Printing

- Transparent conductive film is a thin film that combines excellent visibility and conductivity, used in displays and measurement devices for vehicles and automatic driving.
- Silver nanowires with high conductivity have attracted attention as a raw material, but it was
  difficult to increase the aspect ratio of the wires by conventional technology.
- We have improved the crystal control technology that directly irradiates the silver with microwaves and produced ultra-thin silver nanowires with a high aspect ratio by growing crystals along the vertical axis.
- As energy is selectively transferred to silver nanowire, the new method is more efficient than conventional methods and enables significant reductions in CO<sub>2</sub>.
- DNP will provide product samples in December 2023. In the future, the company aims to provide the product for various sensor applications combined with functional optical films.



(Left) Silver nanowires distribution liquid and FE-SEM image, (Right) Silver nanowire film

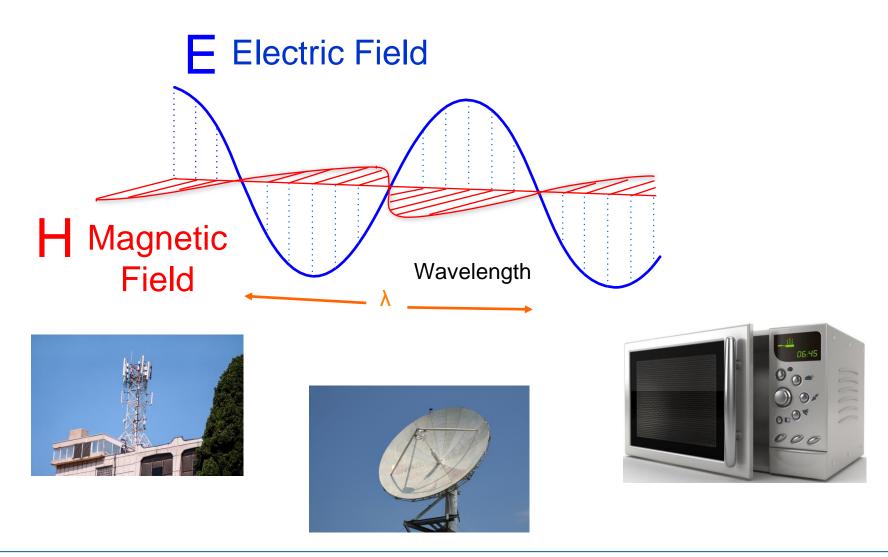
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#### What is Microwave?

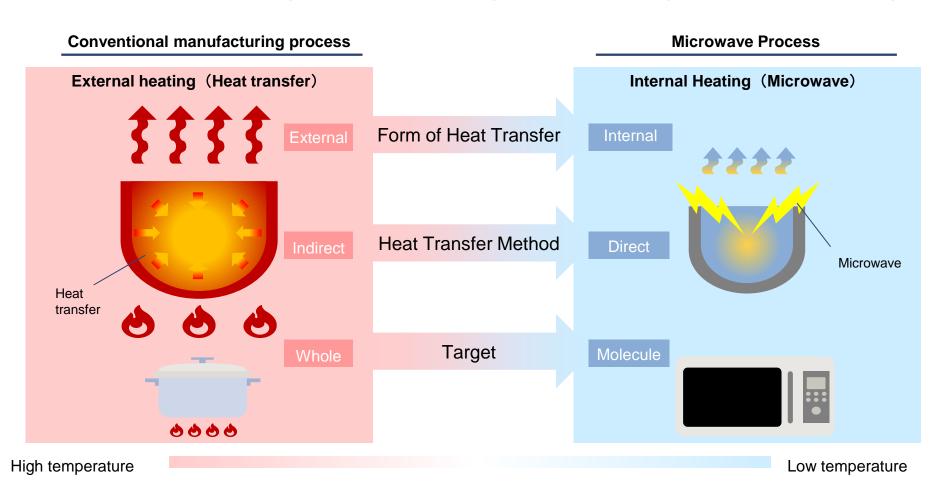
Microwave is an electromagnetic wave used in applications such as wireless base stations, radar-communication systems, and microwave ovens.





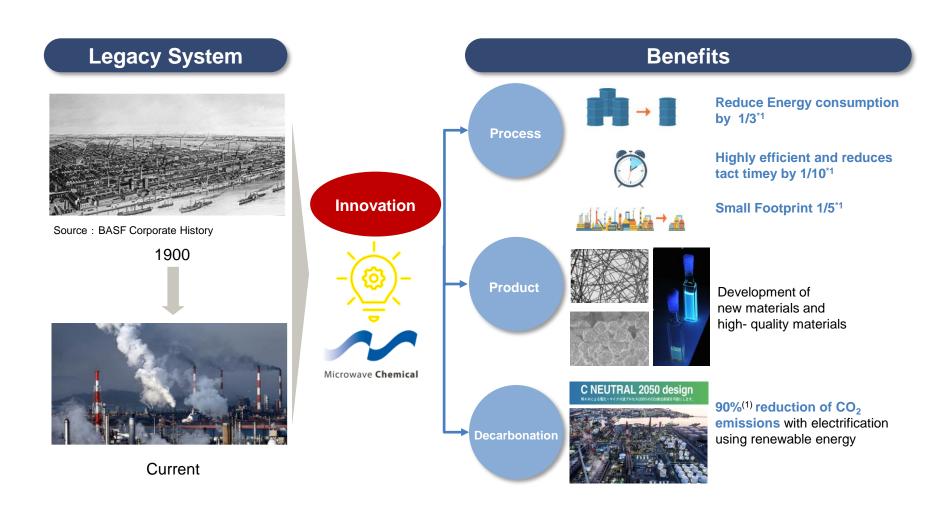
#### Feature of Microwave Process

We will dramatically change the manufacturing process utilizing microwave technology.



\*In the Conventional heat transfer process, energy is transferred to the whole object indirectly through external material. On the other hand, microwaves process transfers energy to the target molecule directly from inside. **Totally opposite approach**.

### Benefit of Microwave Process (1/2)

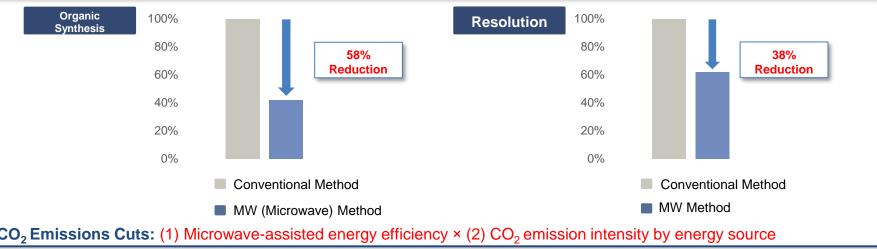


Note:

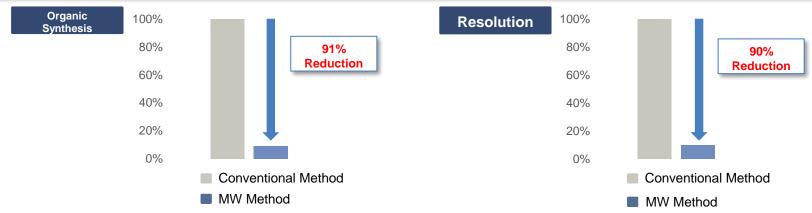
(1) The figures are estimated from our plant of fatty acid esters operated in Osaka

### Benefit of Microwave Process (2/2)

#### Energy consumption: (1) Energy saving with microwave systems



#### CO<sub>2</sub> Emissions Cuts: (1) Microwave-assisted energy efficiency × (2) CO<sub>2</sub> emission intensity by energy source



- CO<sub>2</sub> emission cuts are calculated by multiplying (1) energy consumption by ()2 energy sources used. Use of microwaves reduces energy consumption in many chemical reaction processes. There is a trend that chemical manufactures across the world are laying out their roadmaps, assuming that they significantly reduce the use of conventional fossil fuels to shift to natural energies, which will diminish the intensity of CO<sub>2</sub> emission from energy sources.
- MW Method assumes the use of photovoltaic electricity, CO2 emission reductions and energy equivalent reductions are our estimates. Conventional method data is our trial calculation, and MW method data is based on our demonstration machine at commercial level



### Comparison – Electrification Technology

Microwave process is the only process that transfers energy directly, which provides advantage, such as scaling up, energy efficiency, and temperature range.

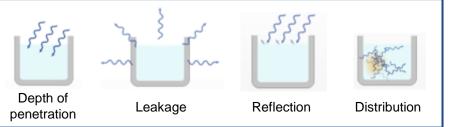
	Microwave Heating	Induction Heating	Electric heater Heating
	MW		
Energy Transfer	Direct	Indirect	Indirect
Scaling Up	Easy	Restricted	Restricted
Energy Efficiency	High	Medium	Low
Temperature Range	-100°C 0°C 1,000°C	-100°C 0°C 1,000°C	-100°C 0°C 1,000°C



#### Success in Scaling Microwave Process to Industrial Level

#### **Challenges for Industrial Applications of Microwaves**

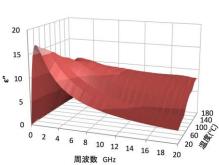
In the chemical industry, many useful experimental results using microwaves have been reported in papers since the 1980s. However, because microwaves are "waves," it is extremely difficult to control. Therefore, industry norm was that the microwave technology cannot be used in industrial setting and only in the lab.



#### **Solved by Our Unique Approach**

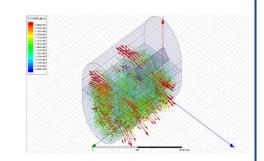
#### **(Reaction System Design)**

Developed data base of absorption rate of each molecule through our proprietary measurement technology. Design reaction utilizing the database by recognizing the pattern.



#### [Reactor Vessel Design]

Develop simulation technologies, couple electromagnetic field and thermic fluid analyses to increase the granularity in simulating the state, and introduce supercomputers, so as to apply to large-sized and complex reactor vessels



#### **Realizing Industrial Applications of Microwaves**

Completed large-scale chemical plant using microwave chemical process in Osaka in 2014 and started commercial operation complying with various laws and regulations such as the Fire Service Act.

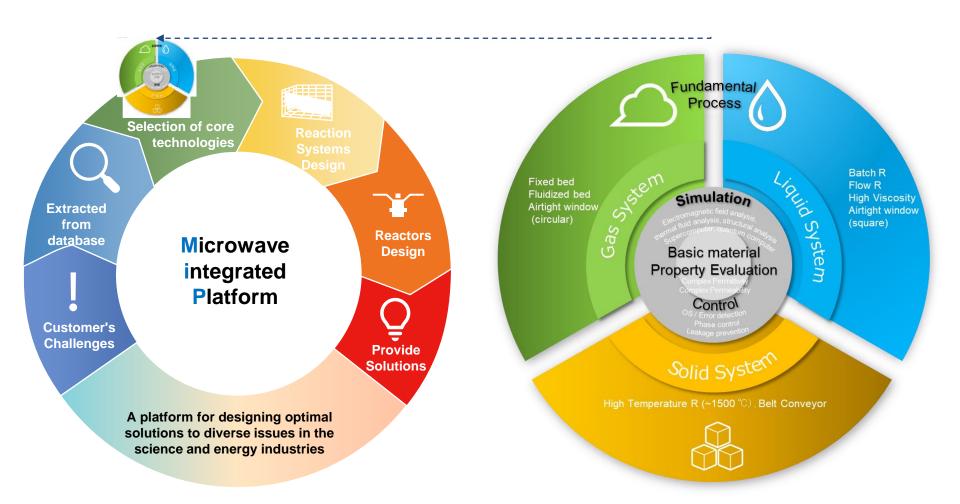




### Technology Platform and Core Technologies

#### **Our Technology Platform**

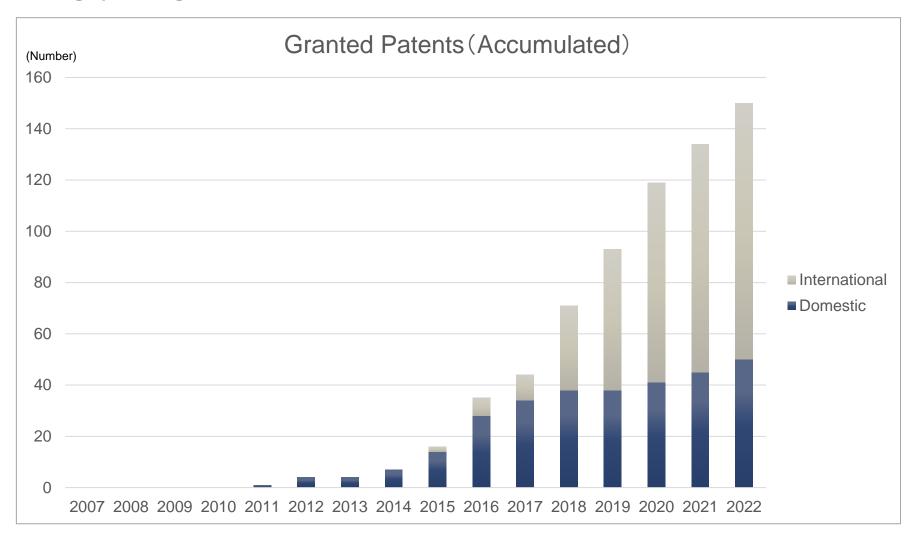
#### **Our Core Technologies**





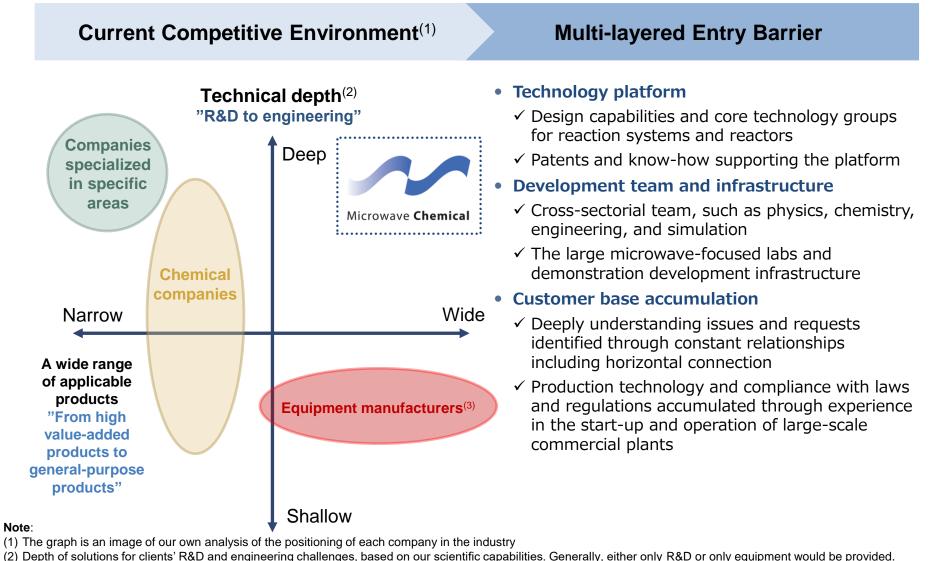
### Patent Strategy

To ensure a competitive advantage, knowledge regarding reaction and reactor design is kept confidential as trade secrets, while knowledge centered around hardware is protected through patenting.



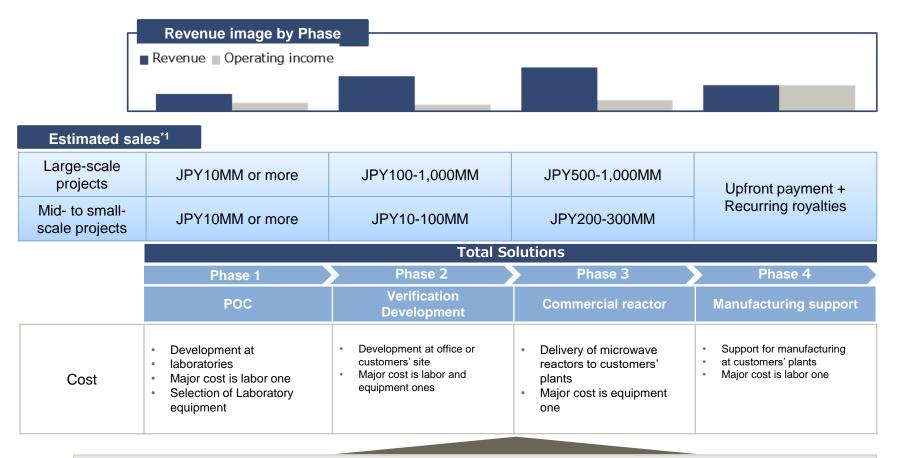


### Competitive Landscape



(3) Mostly machine manufacturers

### **Earnings Structure**





#### **Technology Platform**

**Development Team (Scientists and Engineers)** 

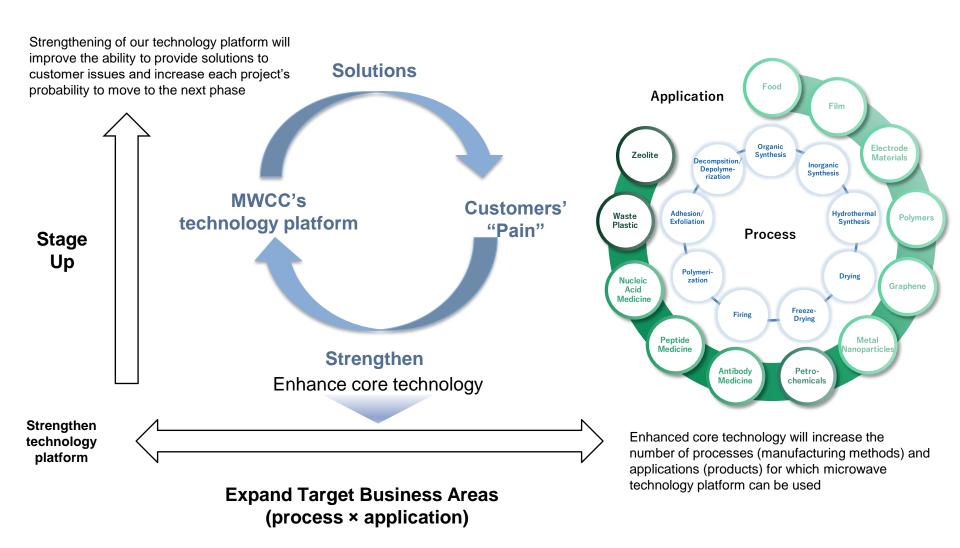
**Development Infrastructure (Laboratories, Pilot facilities, and Calculator)** 

Note: Currently, no recurring royalties have been recorded

<sup>\*1:</sup> Assumed sales size classification based on past performance for each Phase, amounts are our estimates based on past results



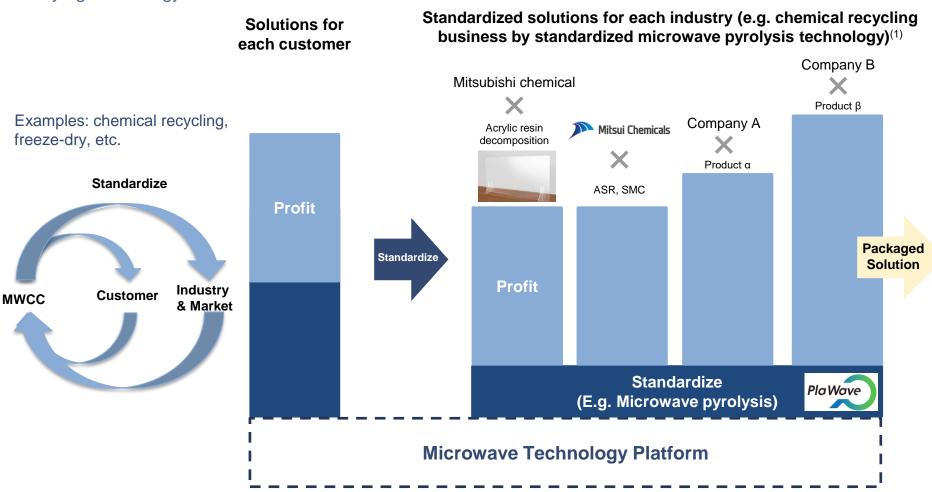
### Virtuous Cycle Drives Growth





#### Standardization Drives Growth

We scale our business by "standardizing" our technology platform and providing solutions to "pains" which is common to industries and markets. For example, we have conducted chemical recycling business using microwave pyrolysis technology, pharmaceutical-rerated and food-related business using microwave freezedrying technology.



Note:

(1) The graph is an illustration of our own analysis of the scale of the business

#### **Potential Market**

- Customers pay fees for our solutions mainly from R&D expenses and CAPEX
- As such, the potential market size is considered to be <u>the</u> <u>part of the total amount of R&D expenses and CAPEX in the overall manufacturing industry</u>, including chemical, medical, foods, and oil refinery
- In the chemical industry, sales, CAPEX, and R&D expenses increased 3.9%, 4.6%, and 5.1% per year, respectively, from 2010 to 2020, which is expected to continue (3)

CAPEX: JPY 23.2 trillion(1)

R&D: JPY 13.7 trillion<sup>(2)</sup>

# Chemical Industry JPY 416 trillion×1 (worldwide sales)

Calculated based on the following: USD 1 = JPY 109 (average for 2019)

#### Note:

- (1) Guide to the Business of Chemistry 2021 American Chemical Council, August 2021
- (2) Forecast on global annual chemical industry capital expenditures 2019-2023
- (3) Research spending continues on an upward trajectory ) <a href="https://cen.acs.org/business/investment/Research-spending-continues-upward-trajectory/97/i23">https://cen.acs.org/business/investment/Research-spending-continues-upward-trajectory/97/i23</a> 2022 Facts And Figures Of The European Chemical Industry) <a href="https://cefic.org/a-pillar-of-the-european-economy/facts-and-figures-of-the-european-chemical-industry/">https://cefic.org/a-pillar-of-the-european-economy/facts-and-figures-of-the-european-chemical-industry/</a>

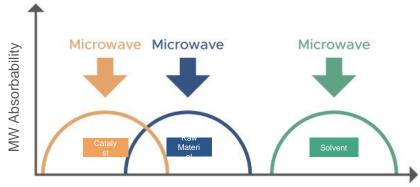


### Reaction design

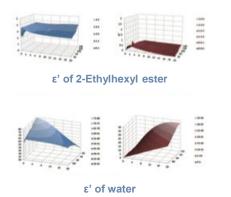
Microwave absorption rate varies by material with frequency and temperature dependency. We design the reaction utilizing this characteristics.

#### Reaction system design

Design Microwave transmission: Which target material at what frequency and temperature.

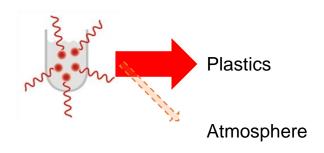


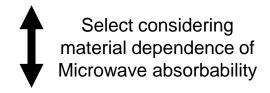
Frequency(GHz)

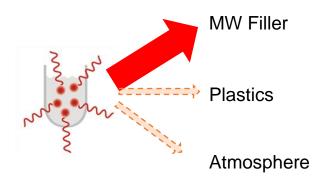




**Use case: Plastic decomposition** 





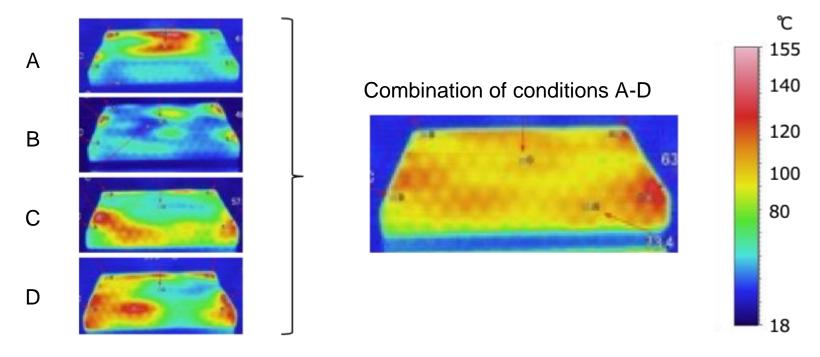




### Microwave phase control

- Microwave is an electromagnetic wave, we realized precise control of the wave utilizing microwave absorption data and novel simulation technology.
- This allowed us to control the temperature distribution of the target material.

ex) By precise control of microwave irradiation condition from A through D, we achieved uniform heating that was difficult with conventional methods.





### **End of Document**



Make Wave, Make World.

世界が知らない世界をつくれ