Kuraray's Initiatives for Innovation

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Kuraray Co., Ltd.

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- Set three challenges to tackle during the medium-term management plan "PASSION 2026" period.

PASSION 2026

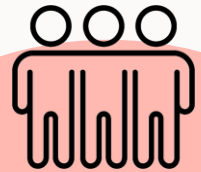
Our Challenges

Sustainability as an opportunity

Take sustainability as an opportunity and promote it with the collective strength of the whole group

Innovations starting from networking

Create a growth driver by connecting people with people, and technologies with technologies, both within and outside the Company



Transformation of people and organization

Transform people and organization via the digital-driven process and the promotion of diversity which will, in turn, help us bring to bear a broad range of ideas

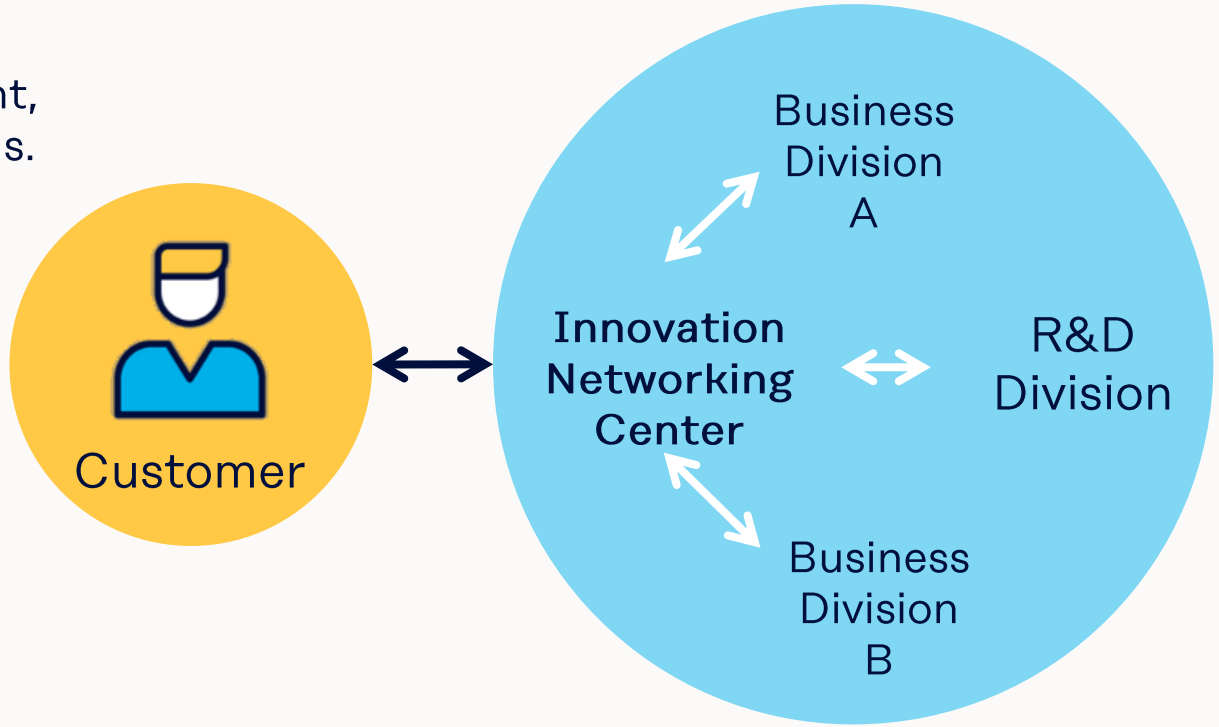
Why the Innovation Networking Center（INC）Was Established

01 Effectively leverage the Group's core capabilities

- Connect the Group's core capabilities such as global talent, technologies, and customers to deliver innovative solutions.

02 Strengthen market-driven innovation activities

- Amidst the evolving external conditions, such as intensifying climate change, expansion of ESG investment, and stricter regulations, we strive to accurately identify the segmented customer needs and challenges to deepen collaboration.



Overview of Our Initiatives for New Business Creation

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Strategic Arena

Networking

- Segment Marketing
- Core Capability Platforms
  (Connect People/Technology/
  Equipment/Customer)

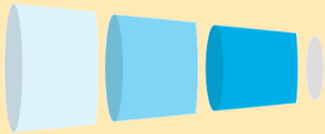
Theme Creation

- Collaboration among
  BU・R&D Division・INC
  (Market-Driven × Technology Driven)
- Open Innovation Activities

New Business Creation

Mechanism to increase the certainty of business creation

Innovation Pipeline



"Someone will make the innovation happen"

→ "Let's all make innovation happen!"

Examples of our Company's Strategic Arenas

Strategic Arenas were decided by all the heads of Business Units and Divisions

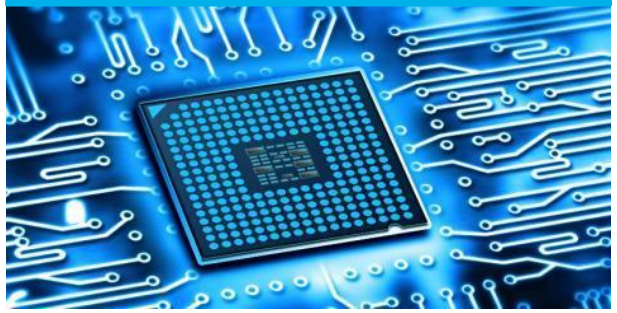
Contributing to Sustainable

Sustainable Materials

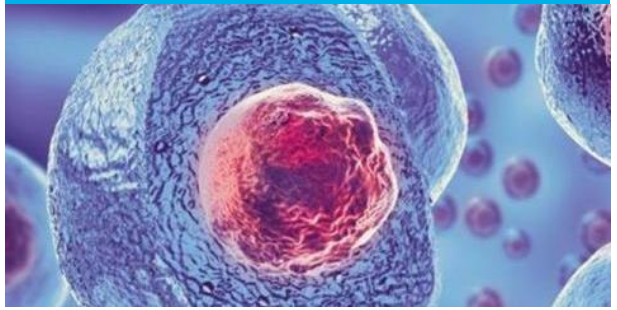
Reduction of GHQ for Architecture

Entry into Growing Arenas

Semiconductor Manufacturing



Cell Culture



Networking Through Segment Marketing Activities

We are engaging in “Segment Marketing” initiatives to promote internal talent and technology exchange, while strengthening collaboration with customers and partner companies

Customer

Business Matching

Strengthening Relationship and Collaboration with Customers and Partner Companies

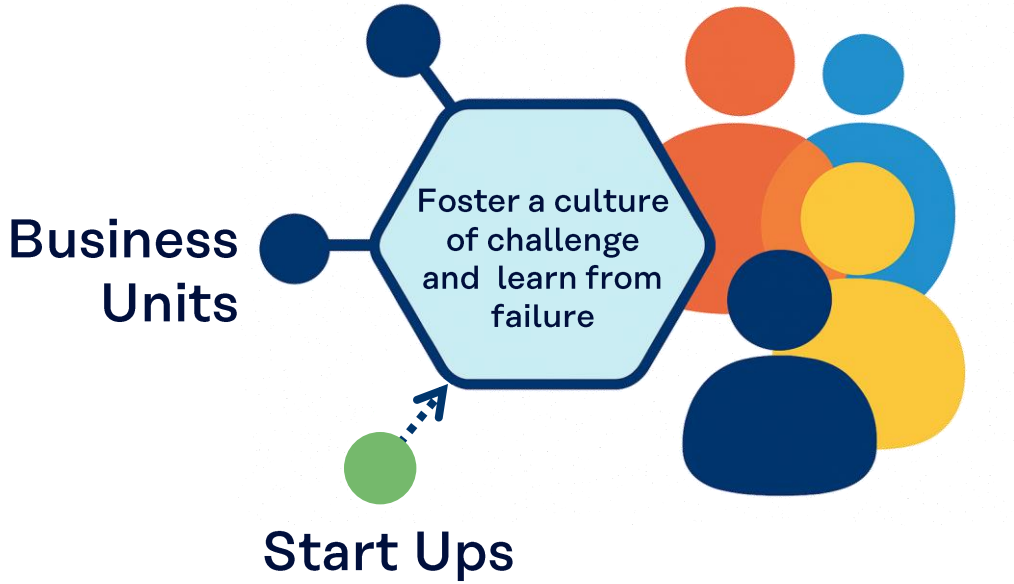
Investment in U.S. Venture Capital

dnxventures

A Japan-US venture capital fund based in Tokyo and Silicon Valley that specializes in investing in early-stage B2B startups.
The total assets under management are 99 billion yen.

Corporate Division

- Innovation Networking Center
- Research and Development Division
- Corporate Management Planning Office



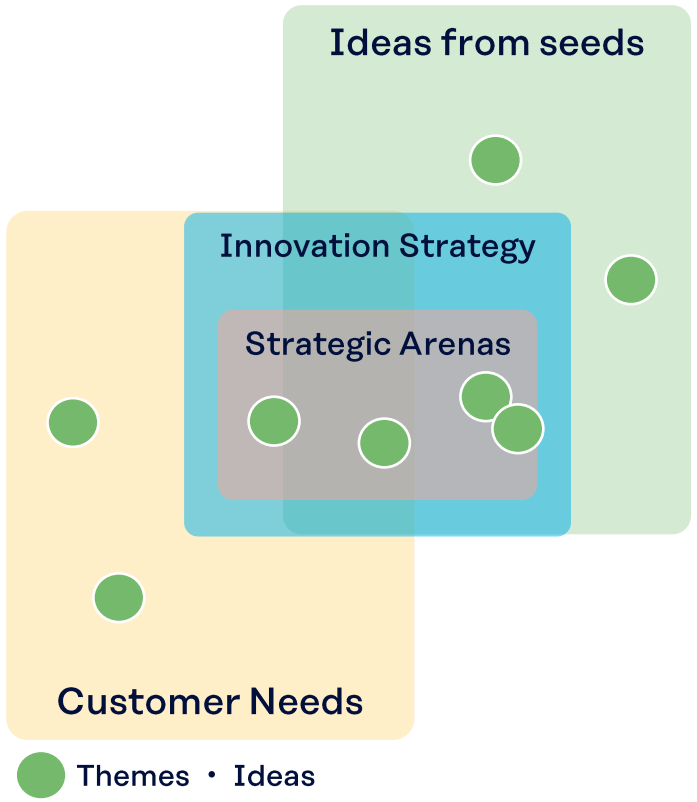
1. **Discover competitive startup technologies**
2. Bring diverse values into the company
   (Foster a culture of challenge and innovation)

Currently two expatriates are stationed at DNX (Silicon Valley)

Mechanism of Innovation Pipeline

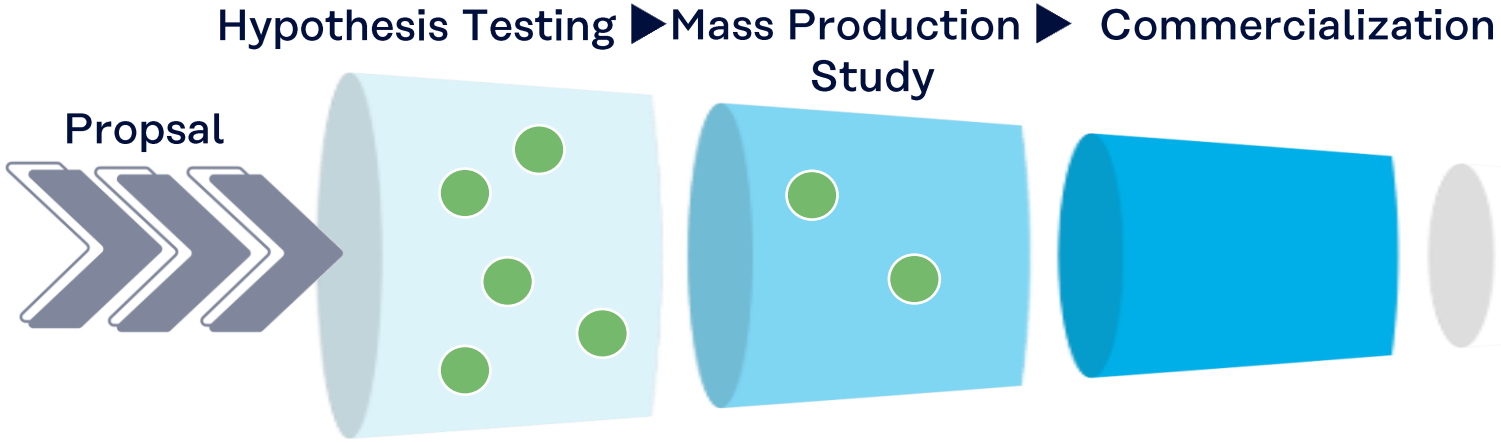
Considering Ideas Over 20

Ongoing Themes 7



Keyword

PFAS alternative technologies,
new functional carbon for batteries,
Bio-based materials, climate tech



Kuraray Innovation Pipeline

Implement a system to identify priorities and increase the certainty for successful business creation

Theme Examples Presented Today

1. Business Expansion Based on Nelumbo's Technology

2. Cell Culture Solution Business

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1

Theme Example 1

Business Expansion Based on Nelumbo's Technology

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About Nelumbo Inc.

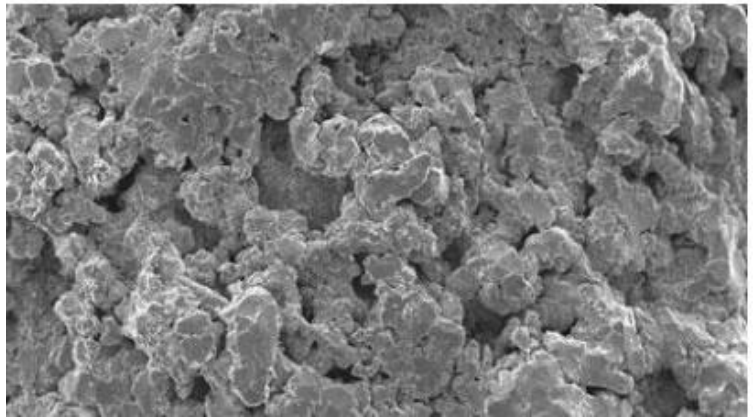
- A U.S.-based startup founded in 2016 based on research from UC Berkeley.
- Funded by global investors including the University of Tokyo Edge Capital Partners (UTEC).

Co-founders:
David Walther
Liam Berryman
Lance Brockway

The Purpose of Acquisition

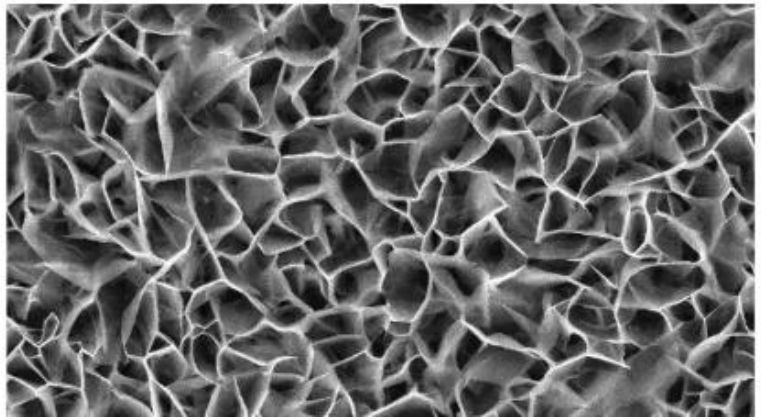
- Contribute to solve social issues such as reducing environmental impact and prevent global warming.
- Integrate new inorganic technologies with Kuraray's proprietary organic chemistry strengths.

- The original formulated inorganic materials enables the formation of unique microstructures that take a position between spray coating and lithography
- Allows functionalization for various substrates
- Achieves both high functionality and scalability for mass production

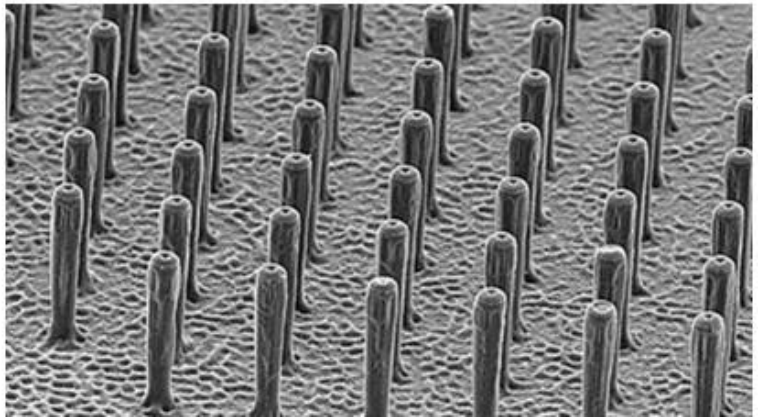


Spray

Advanced spray-coating technology that applies liquid in fine mist across substrates



Nelumbo's Surface Treatment Technology



Lithography

High-precision patterning of resist layers using light or electron beam lithography

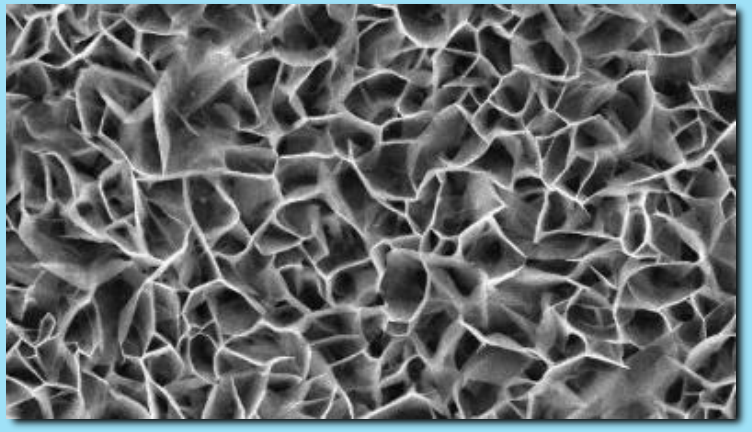
Applications for Nelumbo's Surface Treatment

By combining inorganic base layer with functional top layer, it enables to advance the functionality across wide range of substrates

Substrates

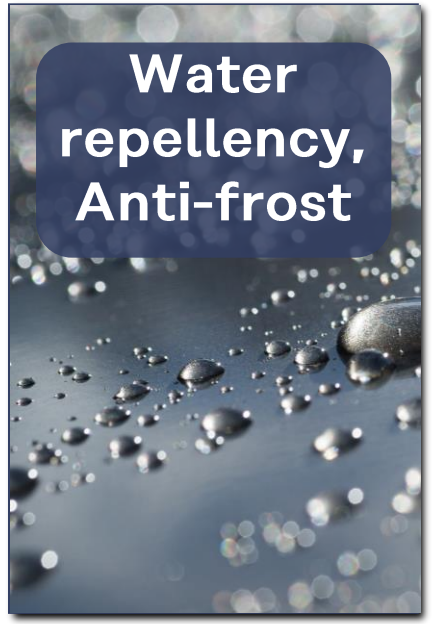
Film, fiber, fabric, aluminum, etc.

Nelumbo's Surface Treatment



Inorganic Layer + Functional Layer

Functionality



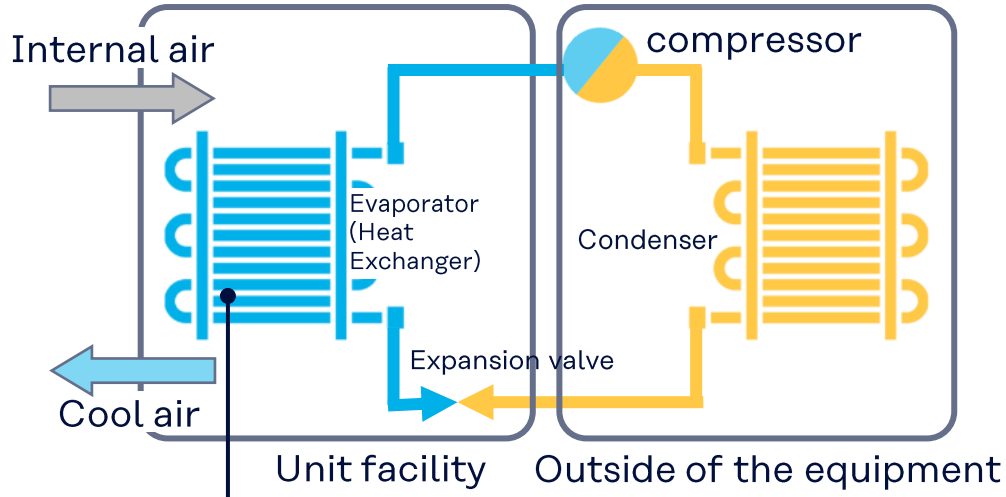
We identified the "Refrigerating System" and "Apparel" as our target market entry areas.
For apparel applications, we are advancing our in-house development from the perspective of PFAS alternatives.

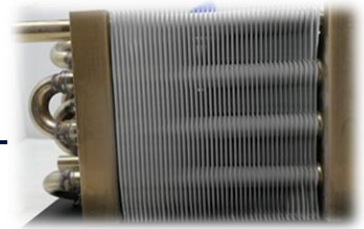
Today's Focus ▶▶▶ **Solutions for the "Refrigeration System Market"**

Concept and Challenges of Refrigeration Equipment

Taking in the air of room and unit → Cooling the air of the heat exchanger → Restore the cool air

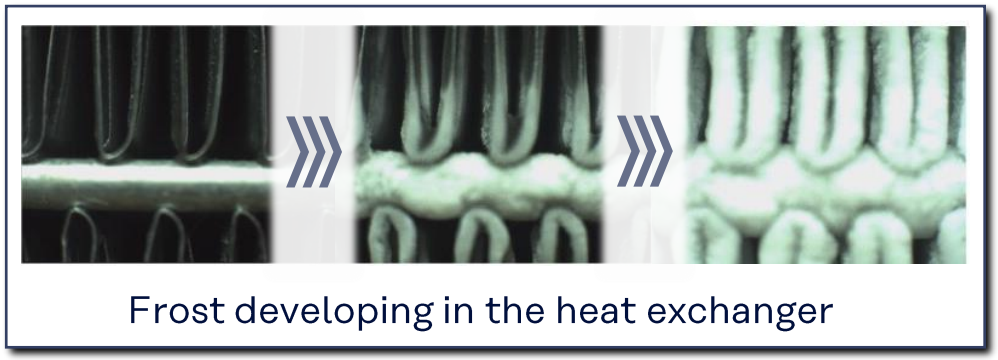
The fins in the heat exchanger enables efficient heat exchange





Challenges

Ice formation and accumulation
→ Reduces cooling efficiency
High defrosting frequency decreases refrigerator temperature
→ Increases energy consumption



Frost developing in the heat exchanger

Our Solution

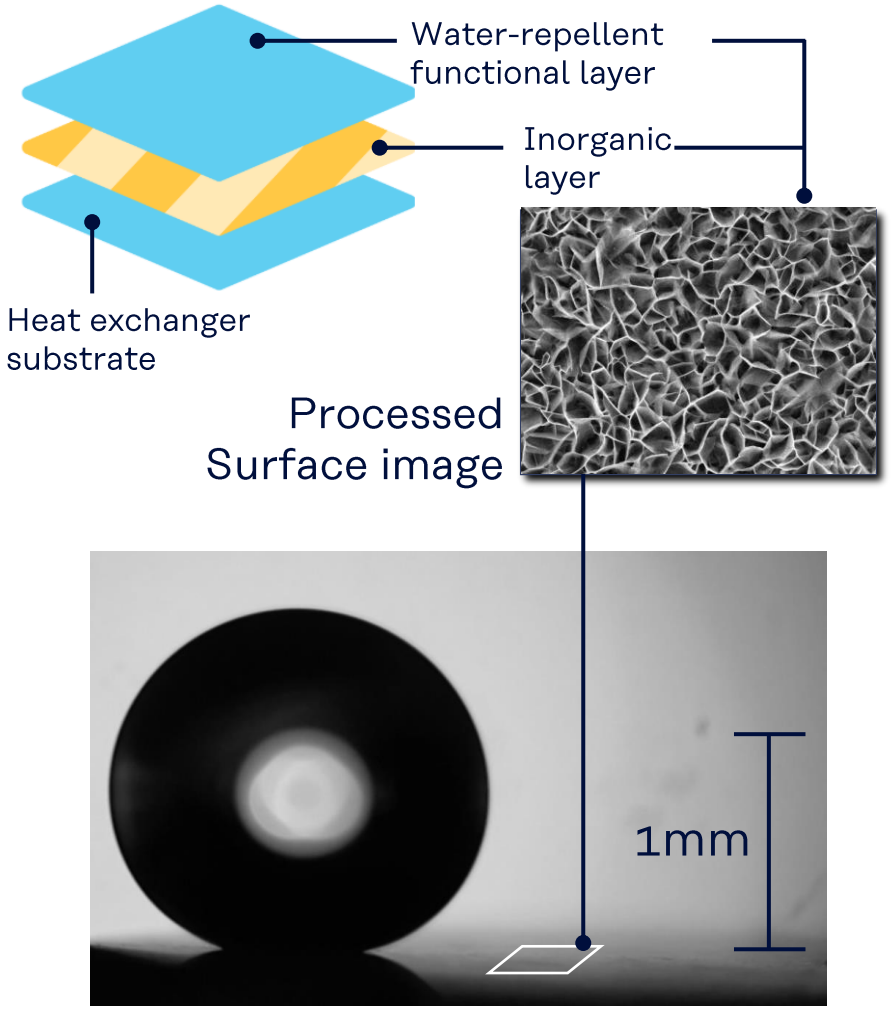
Surface treatment combining inorganic and water-repellent functional layers

Water droplets formed from water vapor in the heat exchanger can be removed from the surface

before freezing inhibits ice formation

- **Reduces the frequency of defrost cycles**
- **Significantly improves the speed and process of defrosting process**

Contributes to energy conservation by reducing energy consumption



Water repellent by surface treatment
Water droplets are removed from the substrate before freezing

Suppression of ice formation by surface treatment

arrow ①

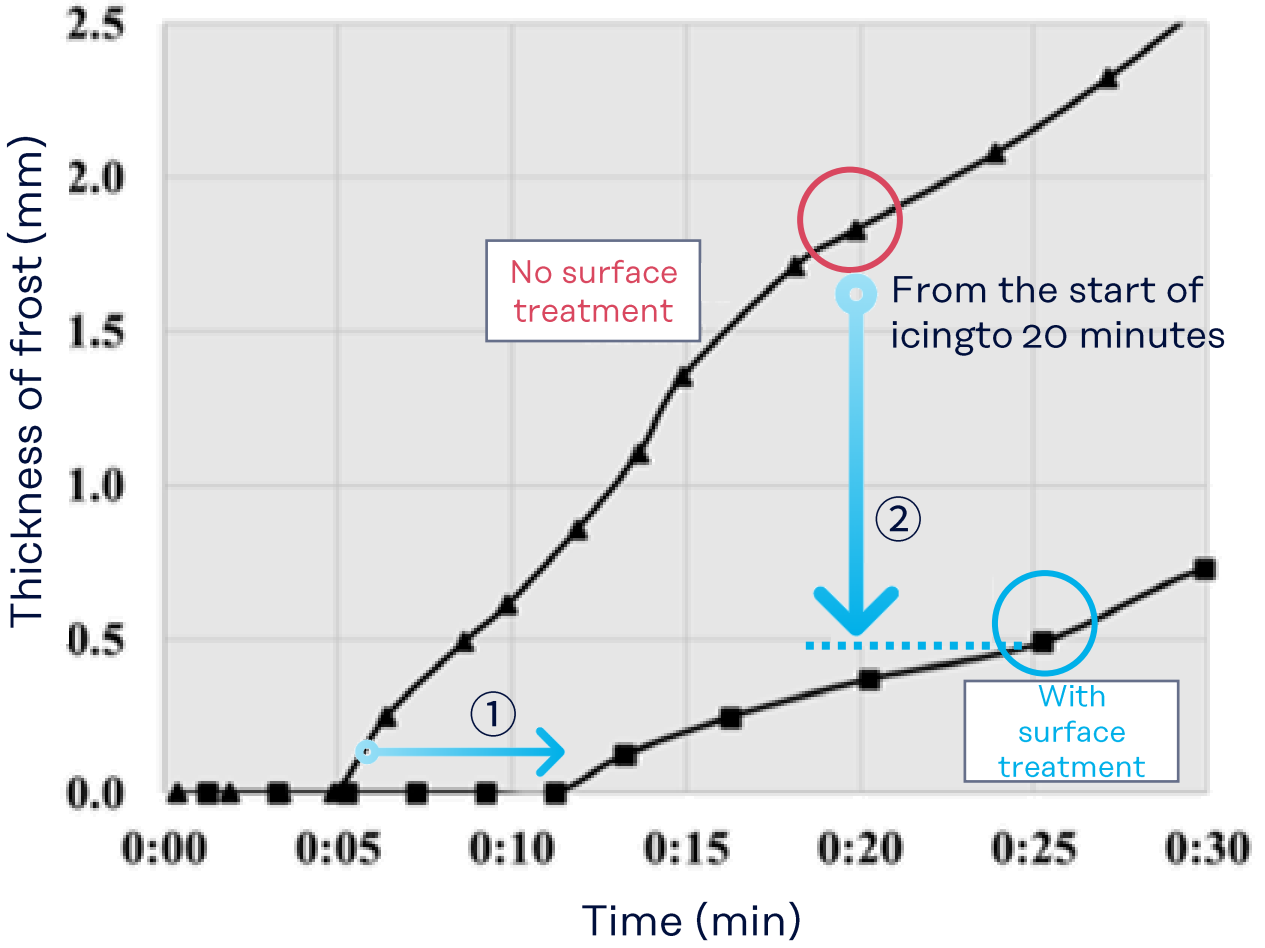
Surface treatment will slow down the time for ice to form
(less ice formation)

arrow ②

The thickness of the frozen layer decreases compared with the same elapsed time
(ice does not accumulate)

- Reduced ice formation rate by 60%
  *Defrost time also reduced by 40%

*Experimental data not listed



Example data on ice formation
(Tested in an environment below 0°C)

Delivering solutions to end users and OEMs

1

For existing refrigerating system - Retrofit business model-

Models that are updated to surface treated heat exchangers during maintenance of refrigerating systems already in use.

2

New refrigerating system products -OEM Business Model-

A model that introduces a surface treatment process within the process of the OEM refrigerating system manufacturer.

Initial Targets and Future Deployments

Initial Target

Transport Refrigeration Unit

- ✓ Reduced fuel usage
- ✓ Improved cargo temperature stability
- ✓ Reduction of CO_2 and other environmental impacts

Future applications

Industrial Refrigeration System

Air conditioning equipment

We are promoting the development of applications with the keyword "frost prevention"

*The image is for illustrative purposes only and does not represent an actual surface treatment.

Integration with internal capabilities and solving customer issues

Nelumbo will integrate surface treatment technology with
in-house capabilities to contribute to solving customer issues through its network.

Nelumbo Surface treatment technology

Automobile

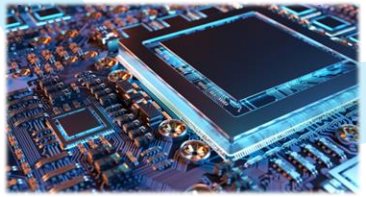
Sports and Outdoors

Architecture and Construction

Inhouse Capability (People • Technology)

Paper and Packaging

Electrical & Electronics



Next Promising Market (Exploration)

Customer

2

Thematic case example 2

Expanding into the Cell Culture Solution Business

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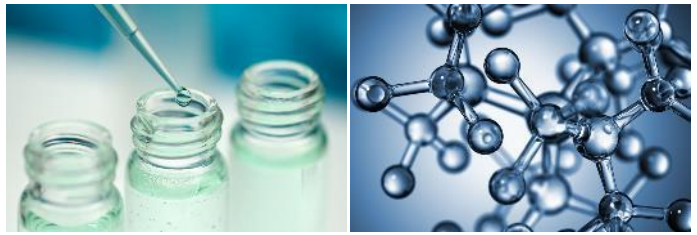
Commodity changes and market trends

- A paradigm shift is beginning to take place in the medical and industrial sectors.
- Cell-based manufacturing is a new industry.

The era of mass culture of cells

Conversion from small molecule pharmaceuticals



Biopharmaceutical
—Antibody drugs and vaccines

Proteins made by Cells used as Drugs.

Regenerative medicine
—Cell and gene therapy

Cells as Medicine

Red Biotechnology

Conversion from petrochemicals

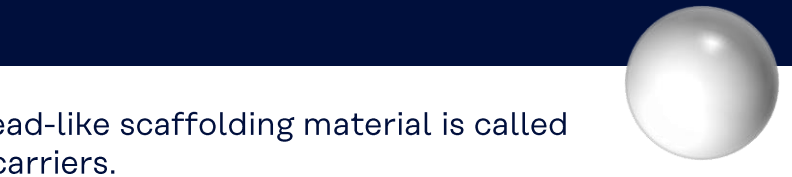
Bio-industry
—Oil fuel and Carbon fixation

Cells as Industrial products

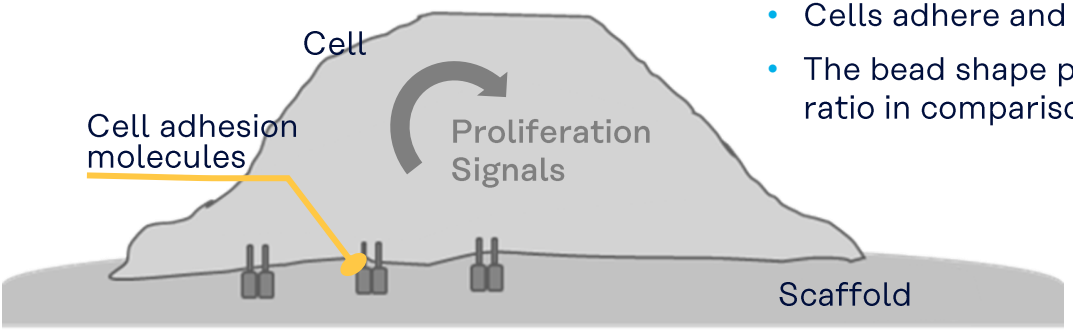
White Biotechnology

High growth is expected in the cell mass culture market

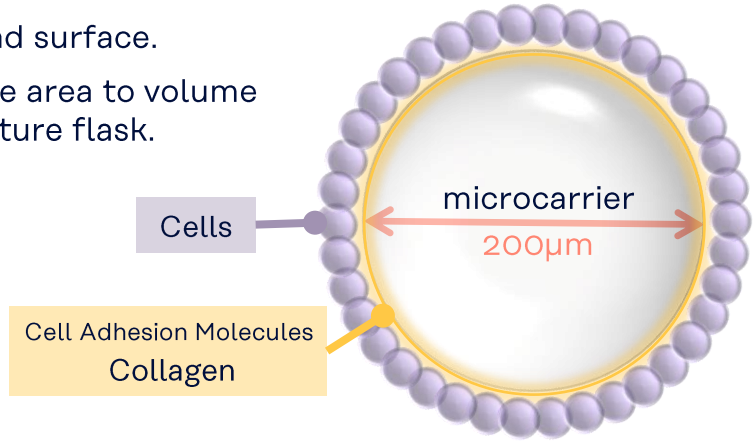
What is a microcarrier?

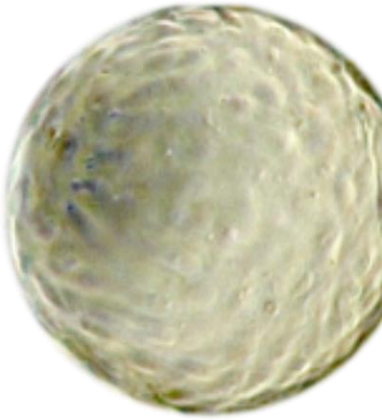


- The bead-like scaffolding material is called microcarriers.
- Cells adhere and proliferate on the bead surface.
- The bead shape provides a large surface area to volume ratio in comparison to conventional culture flask.



Most cells, except blood cells,
Cannot proliferate without scaffolding material to adhere to.





Microcarrier with attached cells

Three-dimensional culture using microcarriers can significantly reduce installation space and culture costs

In three-dimensional culture, a culture tank and a 1 kg microcarrier can culture therapeutic cells for 100 patients.

- Space-saving
- Significant reduction in incubation time (Semi-automated)

In conventional planar culture, Hundreds of culture vessels and incubators to house them are required

- Requires a large culture space
- Difficult to automate, requires a lot of manual labor

Scaffolding made of Kuraray's renowned Polyvinyl alcohol material

Scapova™

1 Cultivation efficiency

- Swells approximately 10 times and increases surface area
- Easy to scale up
- Easy to detach and easy to collect cells

2 Safety

- Extremely low rate of microfractures
- Quality control equivalent to GMP

3 Handling

- Ready to Use
  No washing required before use
- Cellular observation is possible

Collagen coated type

SCAPOVA™ CL

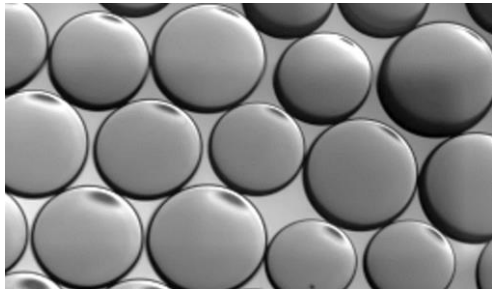
March 2024 Start of sales in Japan
Within 2025 Planned sales launch in the U.S.

Animal-free type that allows surface coating with cell-appropriate protein

SCAPOVA™ AS

Within 2025 Planned simultaneous release in Japan and globally

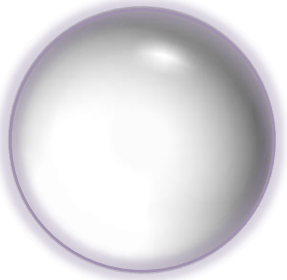
PVA Hydrogel Beads



New

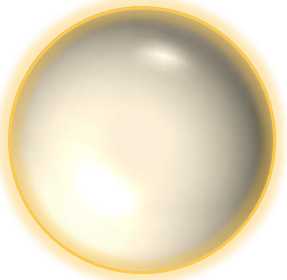
Surface activation treatment

SCAPOVA™ AS



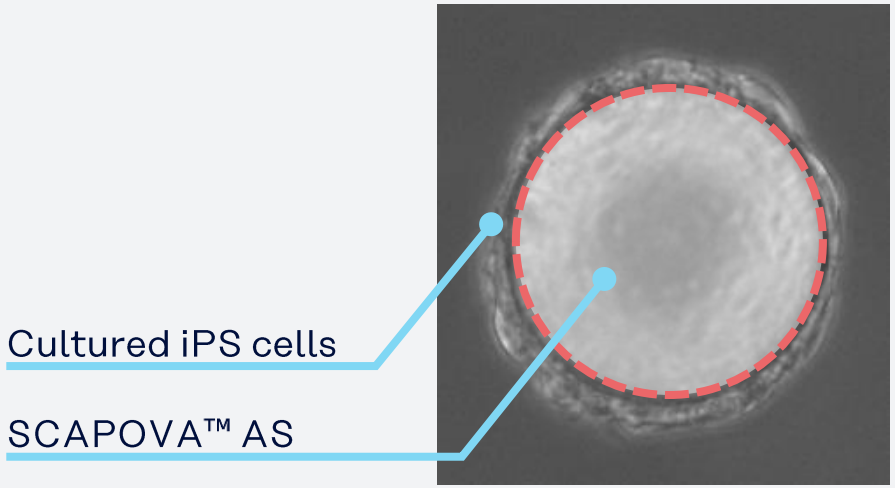
Surface modification with medical-grade collagen

SCAPOVA™ CL



SCAPOVA™ AS

By coating with user-selected cell adhesion molecules, various cell types such as **iPS cells** can be cultured.



An example of culturing iPS cells on SCAPOVA™ AS coated with recombinant laminin protein fragments

Promote product development and peripheral businesses in cell culture-related processes

Cell Production Process	Cell culture	Cells/Culture media separation and recovery	Cryopreservation transport	3D Organization (Organs)	Cell Use (Transplant)
Elemental technology	Mass Culture Technology	Recovery of Culture Fluid Reuse / Wastewater treatment	Preservation technology	Cell stacking technology	Cell Scaffold Technology/ Immunoisolation technique

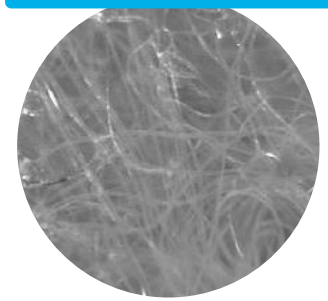
Microcarriers

Water Treatment Technology

Hydrogel

Hollow Fiber Membrane

Fibers & Nonwovens



Implantable Devices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