4M composite upcycling technology for advanced air mobility

4M : Multi-material, Multi-function, Multi-industry and Multi-innovation

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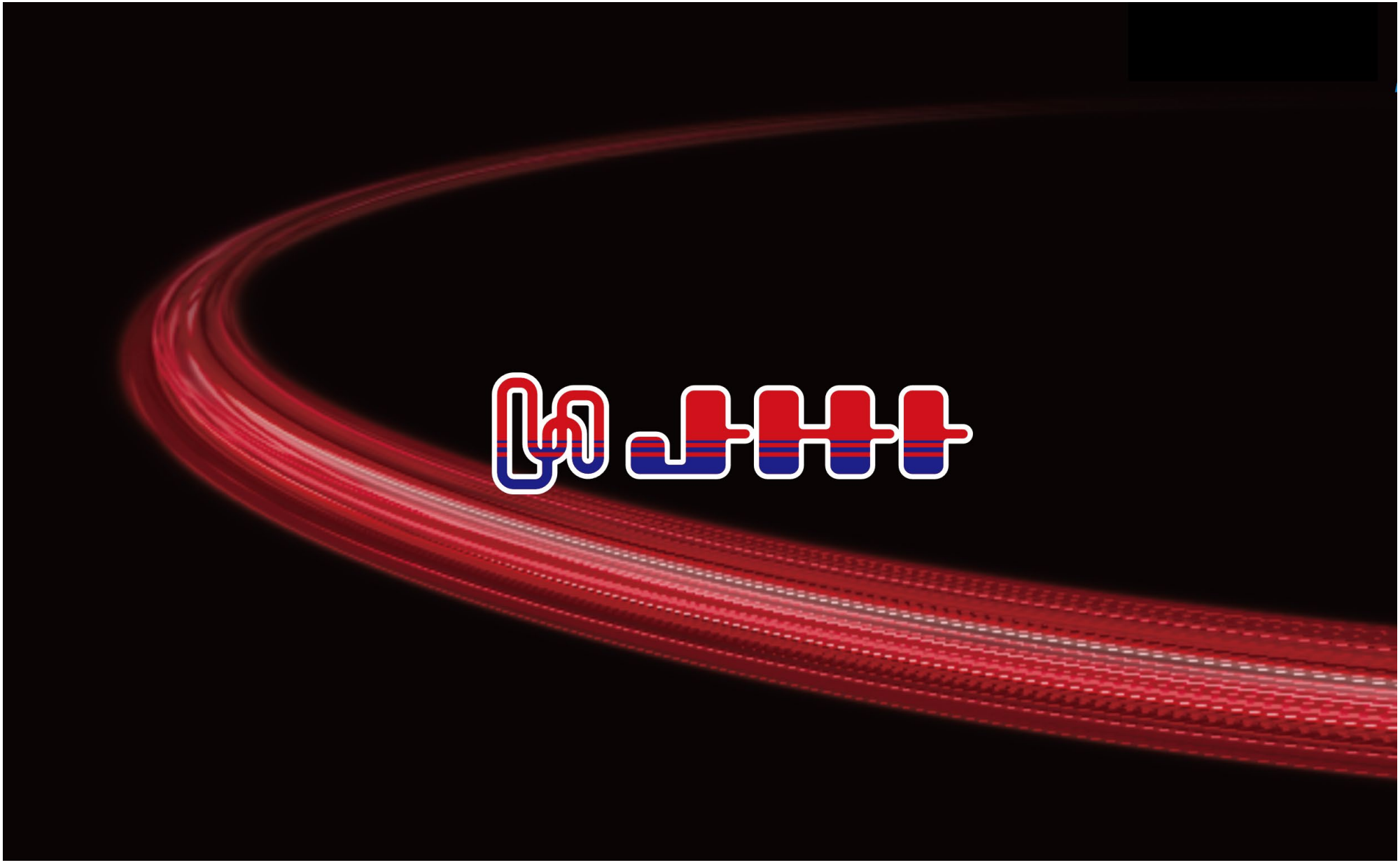
Introduce JHI Company



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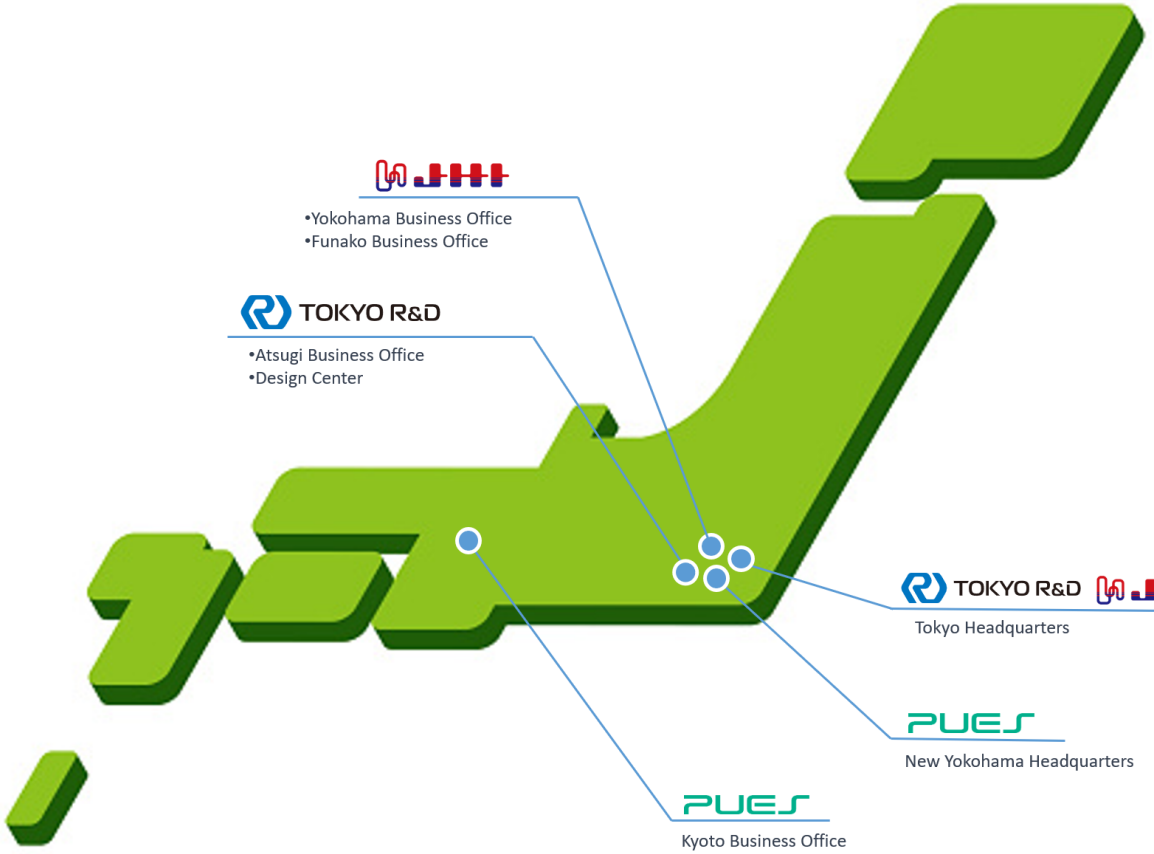
Tokyo R&D Group



TOKYO R&D

- Headquarters: 2nd Floor, Fukuokaseimei Building, 2-2-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan.
- Atsugi Business Office: 1-25-12 Aikohigashi, Atsugi-shi, Kanagawa 243-0013, Japan.
- Design Center: 1-26-5 Aiko, Atsugi-shi, Kanagawa 243-0014, Japan.

JHI

- Headquarters: 2nd Floor, Fukuokaseimei Building, 2-2-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan.
- Yokohama Business Office: 4415-2 Shinyoshidacho, Kohoku-ku, Yokohama-shi, Kanagawa, Japan.
- Funako Business Office: 151 Funako, Atsugi-shi, Kanagawa, Japan.

PUES

- New Yokohama Headquarters: 7th Floor, Shin-Yokohama TECH Building A, 3-9-18 Shin-Yokohama, Kohoku-ku, Yokohama-shi, Kanagawa, Japan.
- Kyoto Business Office: Room 106, KISTIC, 134 Nandojiminamimachi, Shimogyo-ku, Kyoto-shi, Kyoto, Japan.

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About JHI

Company Overview


Yokohama Business Office

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Yokohama-shi, Kanagawa 223-0056,
Japan
TEL： +81-(0) 45-595-0151
FAX： +81-(0) 45-595-0152

151 Funako, Atsugi-shi,
Kanagawa 243-0034,
Japan.
TEL : +81-(0) 46-226-8101
FAX : +81-(0) 46-226-8151


Funako Business Office

Trade Name	JHI Co., Ltd (Formerly Japan Hydro System Industry Co., Ltd.)
Establishment	2015/7/1
Headquarters Location	2nd Floor, Fukuokaseimei Building, 2-2-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan
Capital	10,000,000円
Number of Employees	50 employees (as of September 2023)
President	Hiroshi Fukumuro
Executive Vice President	Kazuyuki Shiraiwa

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Our Products

Hose and Pipe

- Hoses and Piping systems: lightweight, high-pressure, durable, heat-resistant.
- Individual prototypes to small-scale production.

Composite Material Products

- Six autoclave units, large and small, with a flexible method.
- Prototyping to mass production with high strength and lightweight properties.

Machining Products

- Using advanced machining equipment for precise and efficient machining of metals, CFRP, and resin products.

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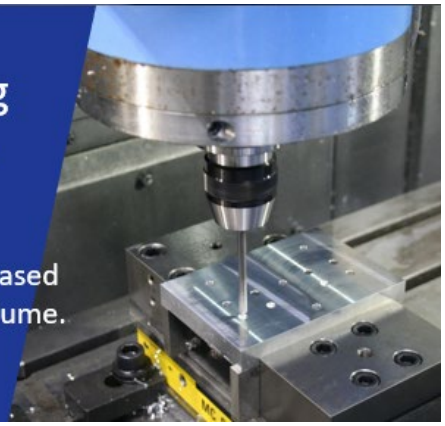
Our Technology

01 Design and Analysis

- Apply 3D CAD for product, mold, and fixture design.
- Optimize layer parameters: orientation angles, fiber types, placement positions, stacking patterns, and layer counts.

02 Mold Manufacturing

- Use 3-axis and 5-axis machining for manufacturing.
- Selecting materials : metal, resin…based on design needs and production volume.
- Use 3D scanner for inspections.

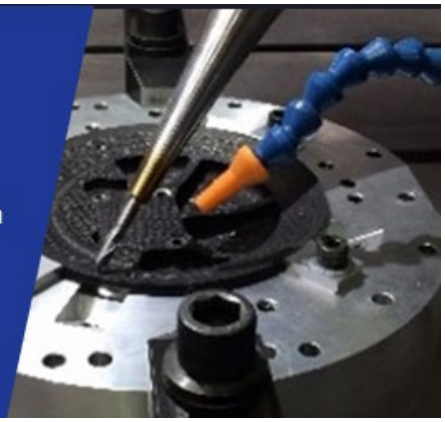


03 Molding (Cure)

- Stacking and checking materials on the mold.
- Shaping with bend-stretch method.
- Directing fiber, bagging, choosing autoclave size, and curing the product.

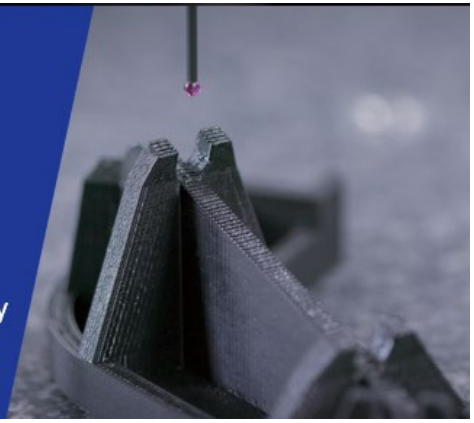
04 Machining

- Depending on the **size, quantity**, and required product **precision**. We process product shapes using a combination of 3-axis, 5-axis machining machines, and various special tools.



05 Inspection

- Including weight, plate thickness, trimming lines, hole diameter, and adhesive processes.
- With final approval from the quality control manager before delivery to customers.



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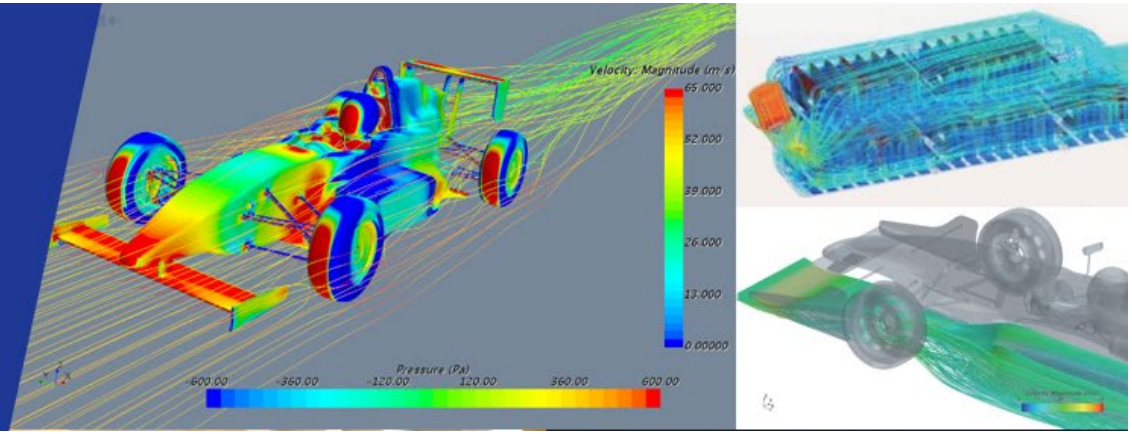
Our Engineering Service

CAE Analysis

- Applying for design, analysis, and evaluation from prototyping to manufacturing.
- Providing complete assistance for various product development requirements.



Restore

- We assist customers with vintage and discontinued cars by manufacturing original parts and proposing unique designs.

AM（Additive Manufacturing）

- Solution focusing on design and analysis in the pre-process phase..
- Provide diverse proposals from design components to functional parts.

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Bearing Holder

Introduction to lightweight and high-performance features

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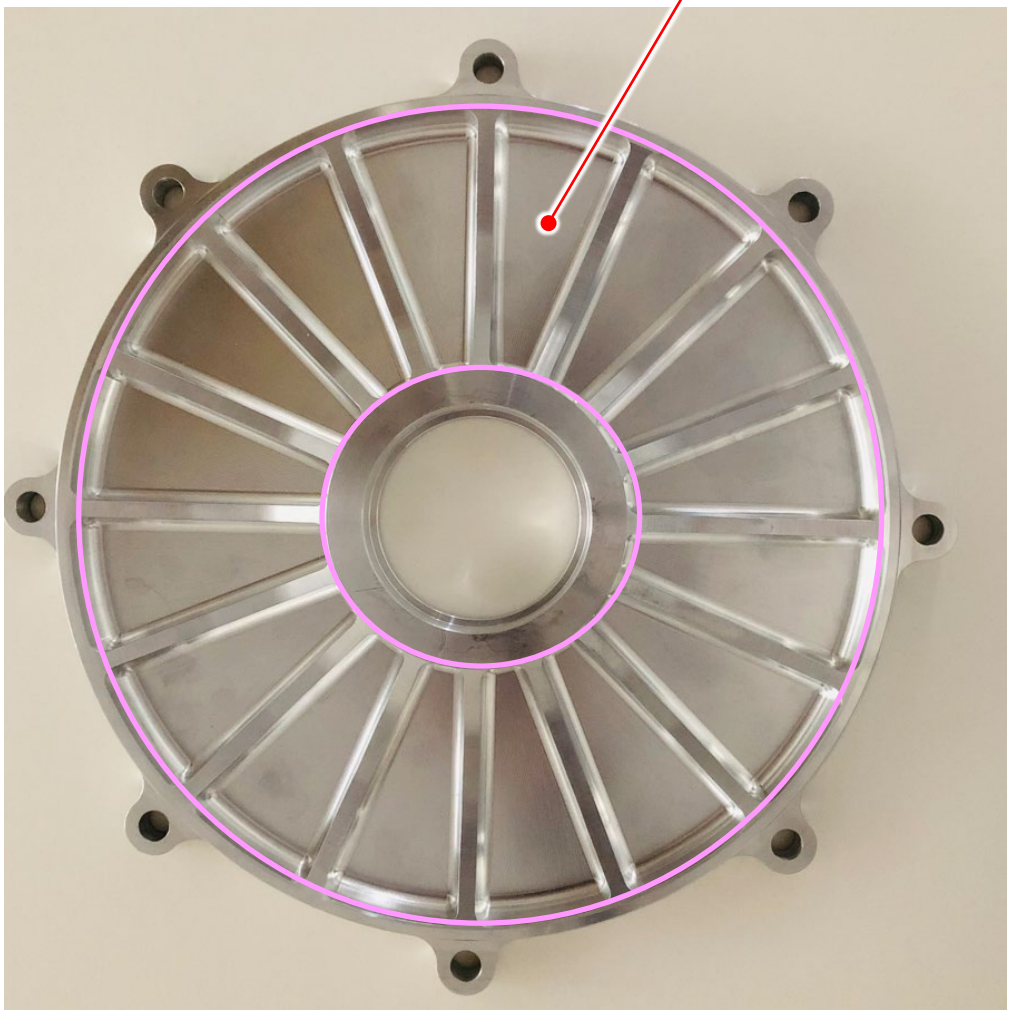
Bearing Holder: Target



Conventional Product
(Aluminium Machined Product)

Development Product
(CFRP+ Aluminium Additive Manufacturing Product)

Lightweighting of aluminum machined products with CFRP + aluminum additive manufacturing.

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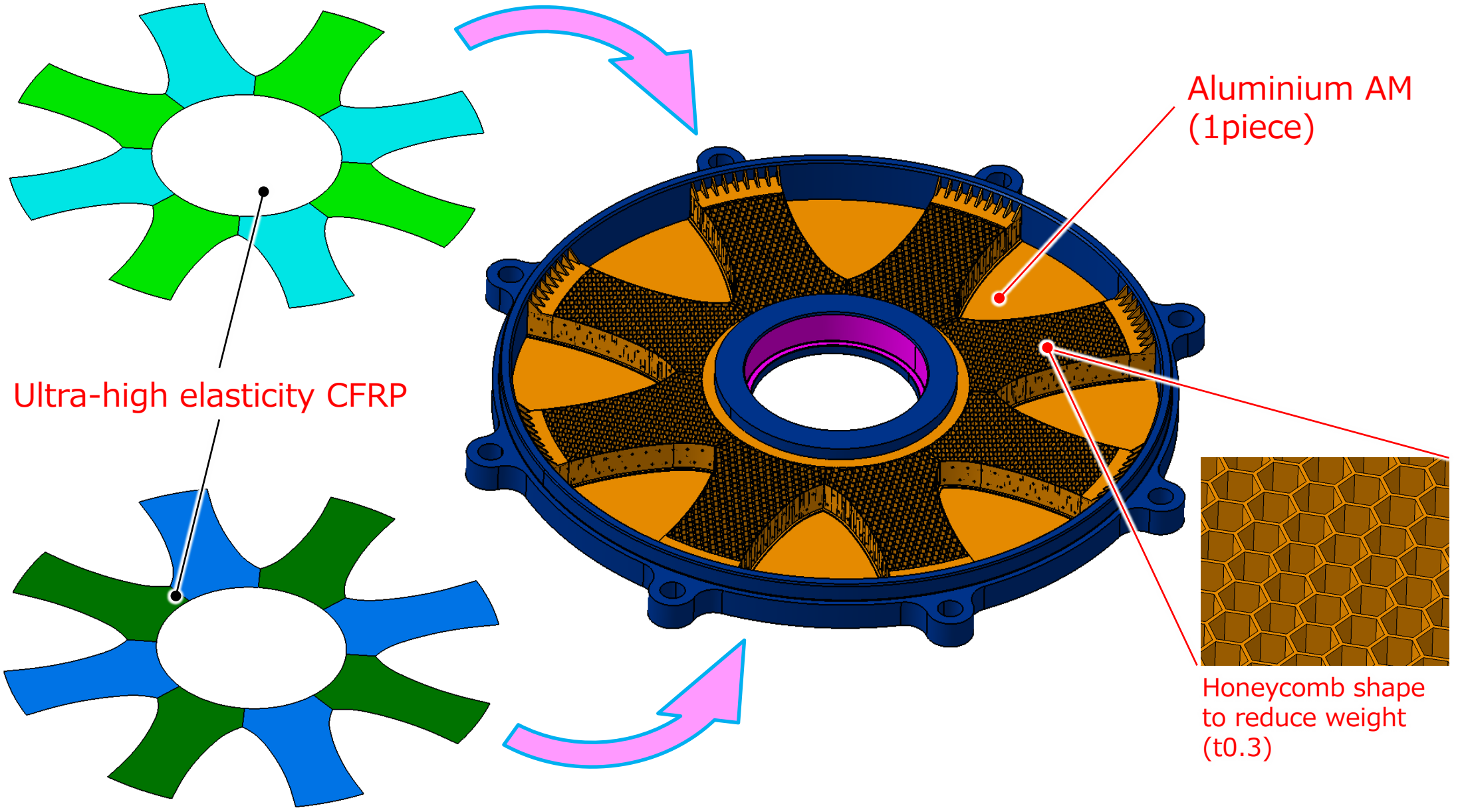
Bearing Holder: Structure



Ensuring strength and rigidity by laminating CFRP to the HoneyComb section of Aluminium AM.

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Bearing Holder: Lightweight effectiveness

	Material	Conventional Product	Development Product
Weight reduction target area	Al	100%	39%
	CFRP	-	6%
	Bonding	-	1%
	Sum.	100%	46%

Achieving equivalent strength and rigidity at 46% of the weight of conventional products
(with the HoneyComb section accounting for 85% of the weight).

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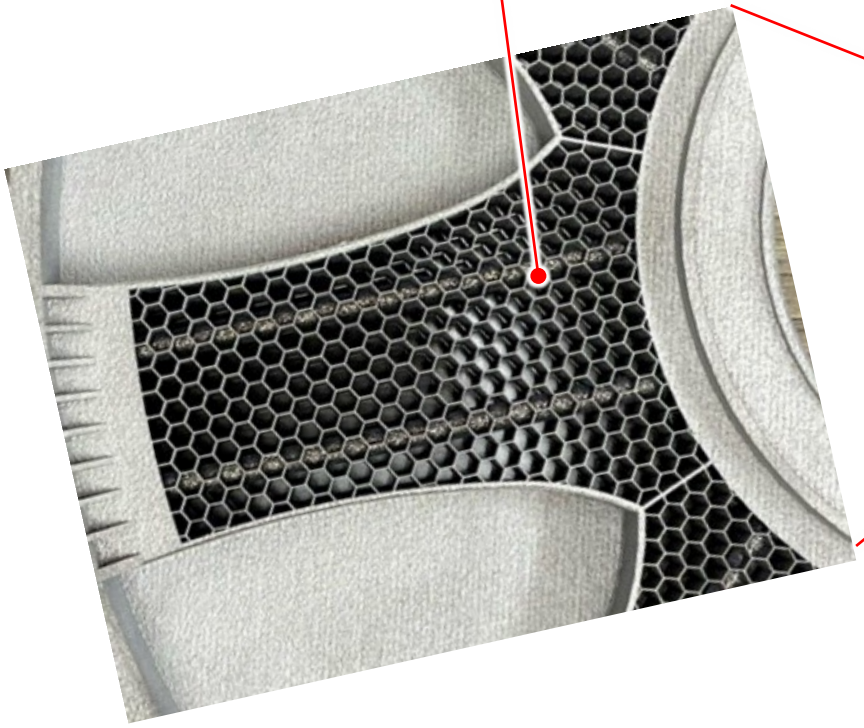
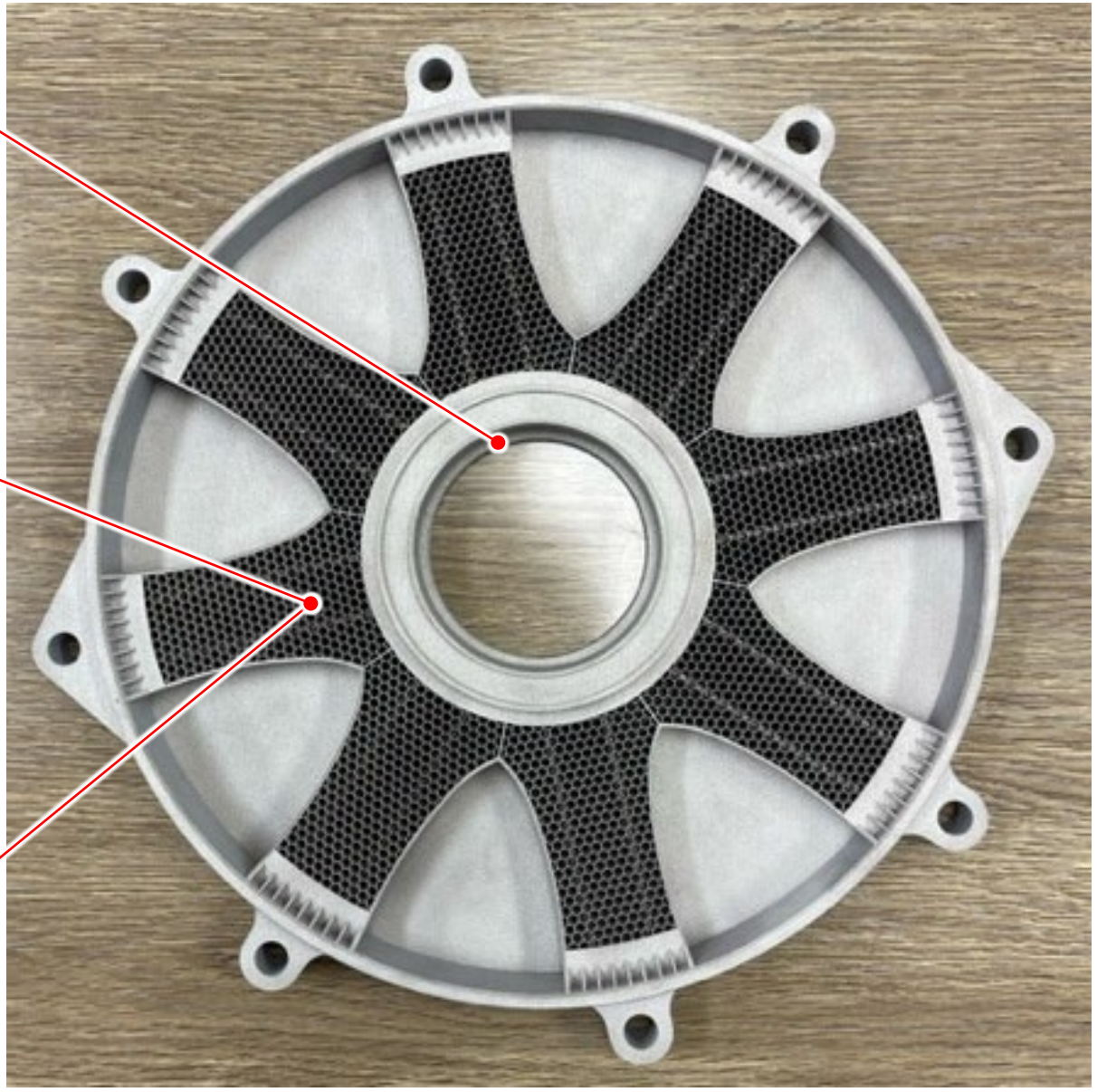
Bearing Holder: Functional effectiveness

Reduced dimensional changes in bearing fitting dimensions → Suppression of **vibration and extension of lifespan**.

Cooling pipes : Molded together with the main body during the aluminum stacking process simultaneously.





Reduced temperature fluctuations through added cooling functionality → Expanded opportunities for cost reduction through the use of certified universal materials.

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Bearing Holder

Summary:

- Utilizing **additive manufacturing** (AM) and **multi-material** approaches, achieving equivalent **strength and rigidity** while **reducing the weight** of aluminum machined products by 54%.
- Addition of **cooling functionality** and **multifunctionalization** leading to reduced temperature fluctuations.
  - Reduced dimensional changes in bearing fitting dimensions → Suppression of vibration and extension of lifespan.
  - Expanded opportunities for cost reduction through the use of certified universal materials.

For future plans, you could consider the following:

- Further weight reduction through optimization of the honeycomb section according to AM manufacturing requirements.
- Evaluation of bonding between Aluminum AM and CFRP.

We provide tailored proposals to meet your specific needs, including lightweighting and enhanced functionality.

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BRAIDED CFRTP PIPE

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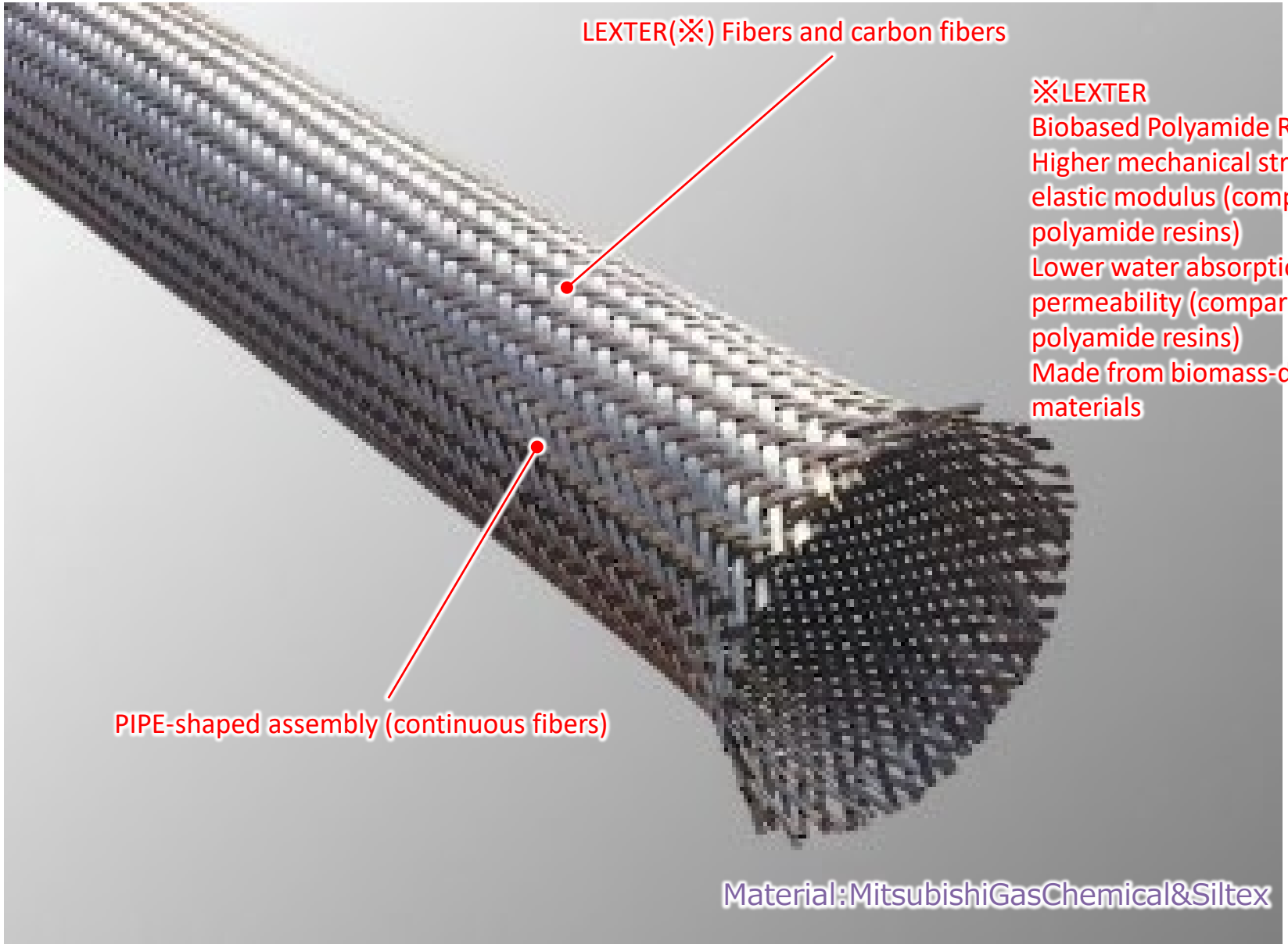
BRAIDED CFRTP PIPE: Materials



※LEXTER
Biobased Polyamide Resins
Higher mechanical strength and greater elastic modulus (compared to other polyamide resins)
Lower water absorption and moisture permeability (compared to other polyamide resins)
Made from biomass-derived raw materials

By incorporating LEXTER fibers in addition to carbon fibers, resin injection (as in the case of RTM(Resin Transfer Molding) method) is unnecessary

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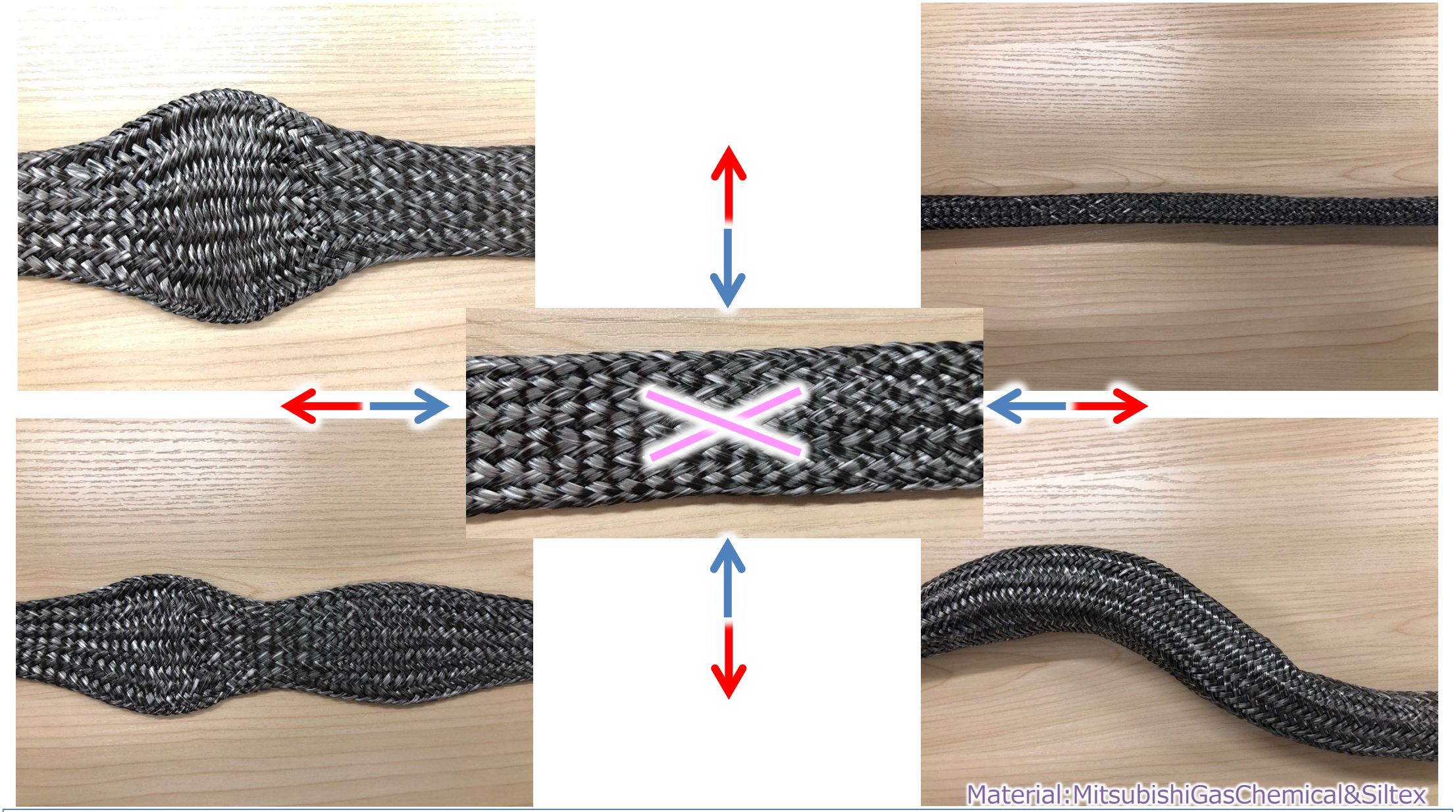
BRAIDED CFRTP PIPE: Deform



Due to axial and radial elongation/shrinkage and changes in fiber crossing angles, various shapes can deform without reduction in strength and rigidity due to fiber fragmentation.

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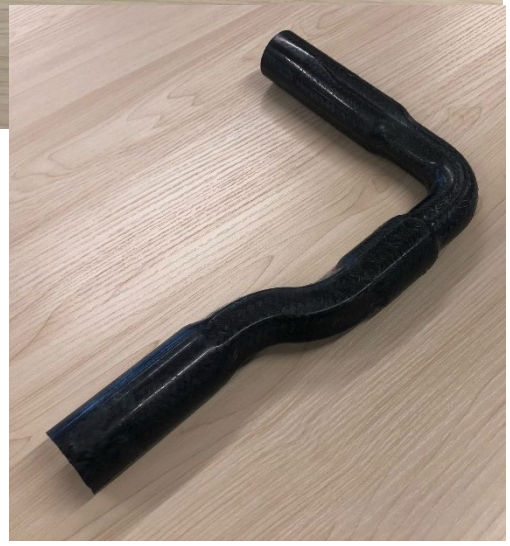
BRAIDED CFRTP PIPE: Mold



Material：MitsubishiGasChemical&Siltex

The assembly has high deformability, allowing for rough material arrangement in the mold. With pressurization and heating, complex-shaped pipes can be molded quickly.

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BRAIDED CFRTP PIPE

Summary:

- By combining LEXTER fibers along with carbon fibers, separate resin injection is unnecessary.
- Various shapes can deform without reduction in strength and rigidity due to axial and radial elongation/shrinkage and changes in fiber crossing angles, eliminating the need for fiber fragmentation.
- The high deformability of the assembly allows for rough material arrangement in the mold, enabling the quick molding of complex-shaped pipes through pressurization and heating.

For future plans, you could consider the following:

- Torsion test, Compression test, Heat resistance test, Internal pressure test, Hydrogen leak test
- Integration molding with metal and rubber products
- Predictive analysis of mechanical properties after molding
- Adhesion (bonding, fusion) evaluation
- Coating evaluation
- Inner surface polishing
- Efficiency, Shortening, and Promotion of Mass Production in the Molding Process

For the application

- Structural components (frames, shafts, irregular section pipes, T-shaped pipes, etc.)
- Piping (coolant, fuel, hydrogen, oil, insulation, double-layer, flexible, etc.)

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Through Multi-material, Multi-function, Multi-industry and Multi-innovation composite upcycling technology

We will contribute to the development of the advanced air mobility industry.

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Thank You!

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