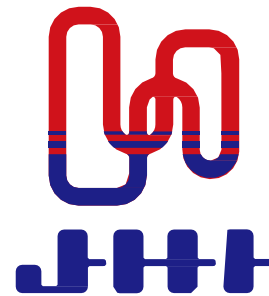


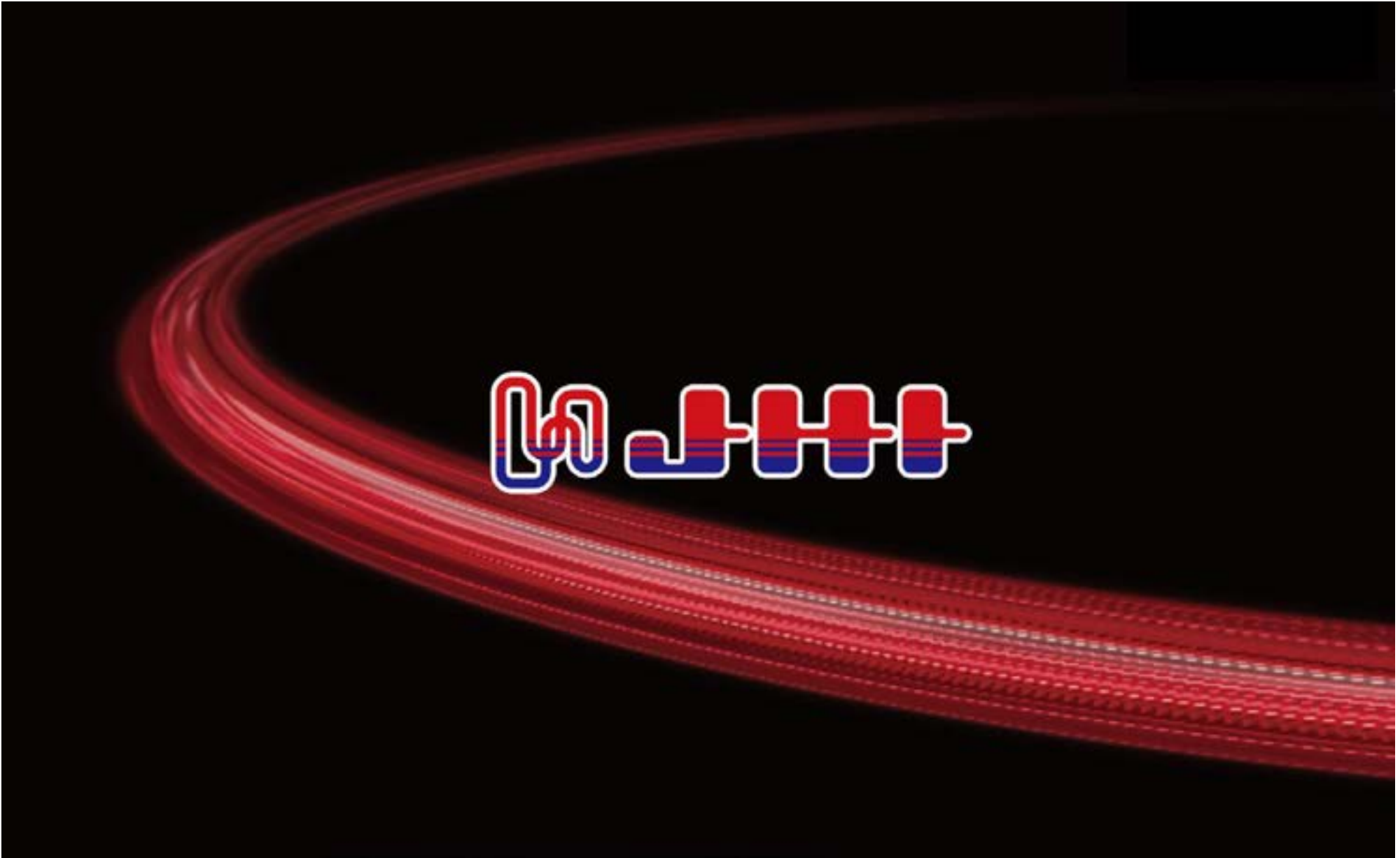
4M composite upcycling technology for advanced air mobility

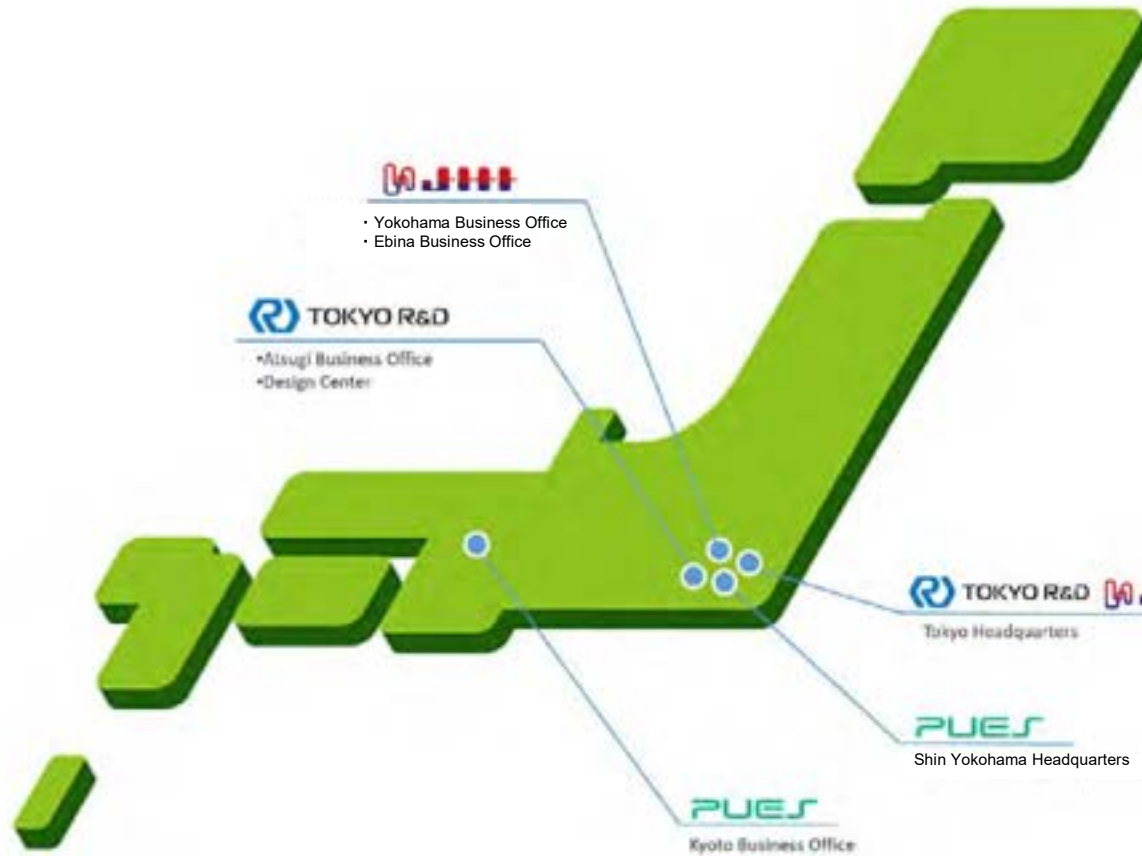
4M: Multi-material, Multi-function, Multi-industry and Multi-innovation

2024/03/20



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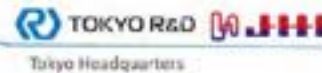




- Headquarters: 2nd Floor, Fukuokaseimei Building, 2-2-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan,
- Atsugi Business Office: 1-25-12 Aikohigashi, Atsugi-shi, Kanagawa 243-0013, Japan.
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- Headquarters: 2nd Floor, Fukuokaseimei Building, 2-2-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan.
- Yokohama Business Office: 4415-2 Shinyoshidacho, Kohoku-ku, Yokohama-shi, Kanagawa, Japan.
- Ebina Business Office: 5-14-5 Nakashinden, Ebina, Kanagawa, Japan



Tokyo Headquarters



Shin Yokohama Headquarters



- Shin yokohama Headquarters: 7th Floor, Shin-Yokohama TECH Building A, 3-9-18 Shin-Yokohama, Kohoku-ku, Yokohama-shi, Kanagawa, Japan.
- Kyoto Business Office: Room 100, KISTIC, 134 Nandojiminamimachi, Shimogyo-ku, Kyoto-shi, Kyoto, Japan.

Company Overview



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Ebina 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 yen
Number of Employees	61 employees (as of July 2025)
President	Izumi Miyashita
Executive Vice President	Kazuyuki Shiraiwa

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.



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.



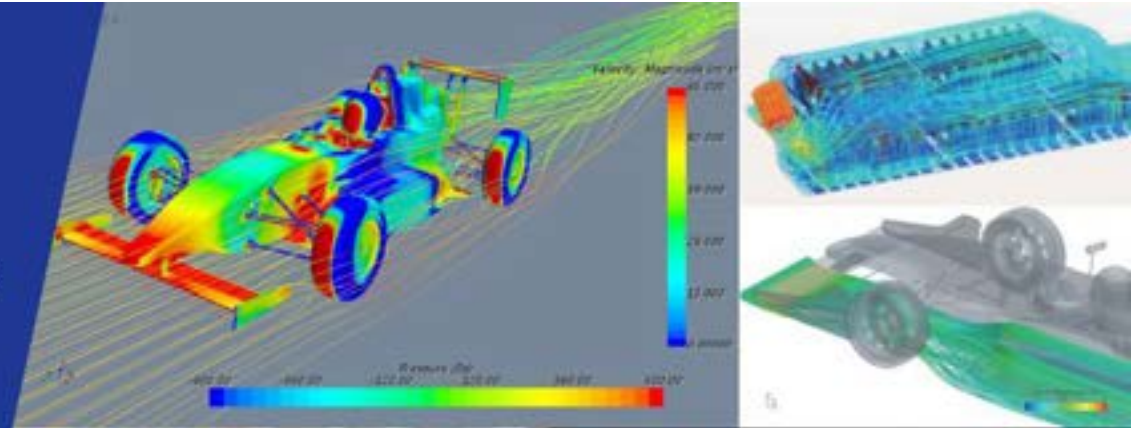
05 Inspection

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



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)

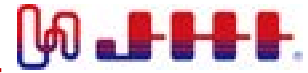
- Solution focusing on design and analysis in the pre-process phase..
- Provide diverse proposals from design components to functional parts.



Bearing Holder

Introduction to lightweight and high-performance features

Bearing Holder: Target



Weight reduction target area



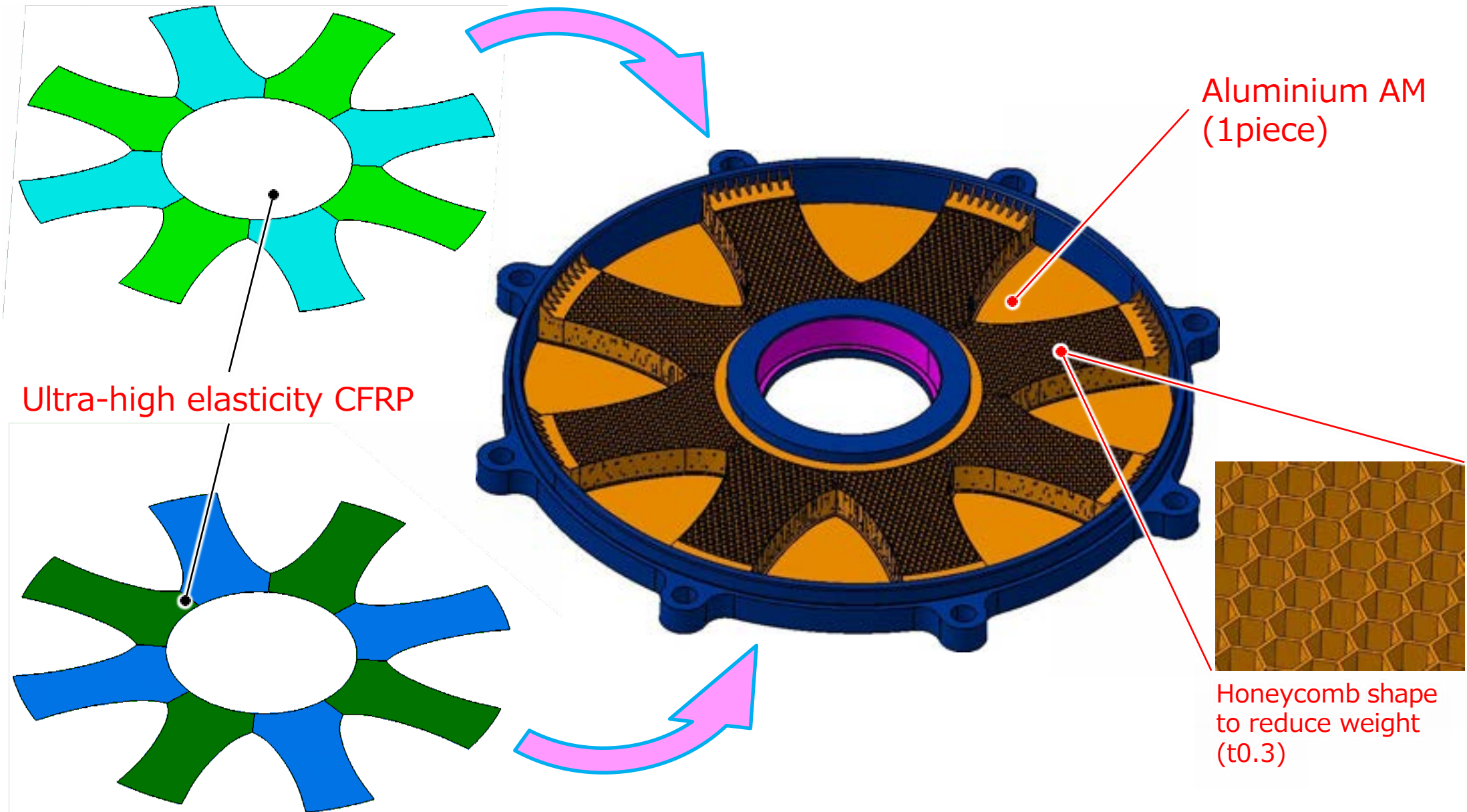
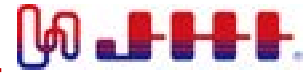
Conventional Product
(Aluminium Machined Product)



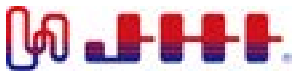
Development Product
(CFRP+ Aluminium Additive Manufacturing Product)

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

Bearing Holder: Structure



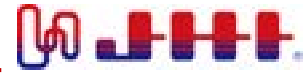
Ensuring strength and rigidity by laminating CFRP to the HoneyComb section of Aluminium AM.



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

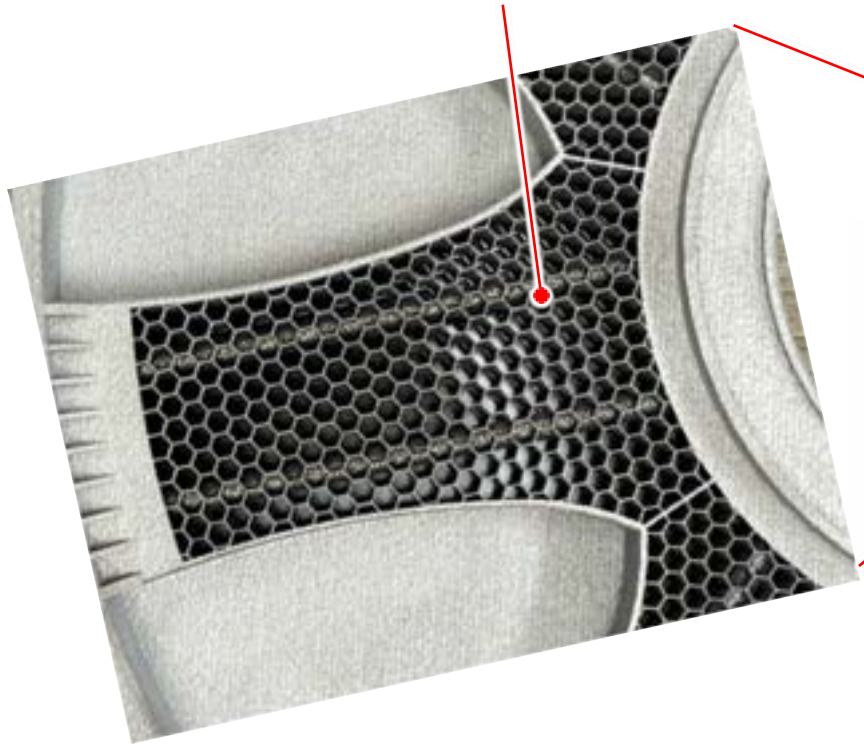
Achieving equivalent strength and rigidity at 46% of the weight of conventional products (with the HoneyComb section accounting for 85% of the weight).

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.

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.

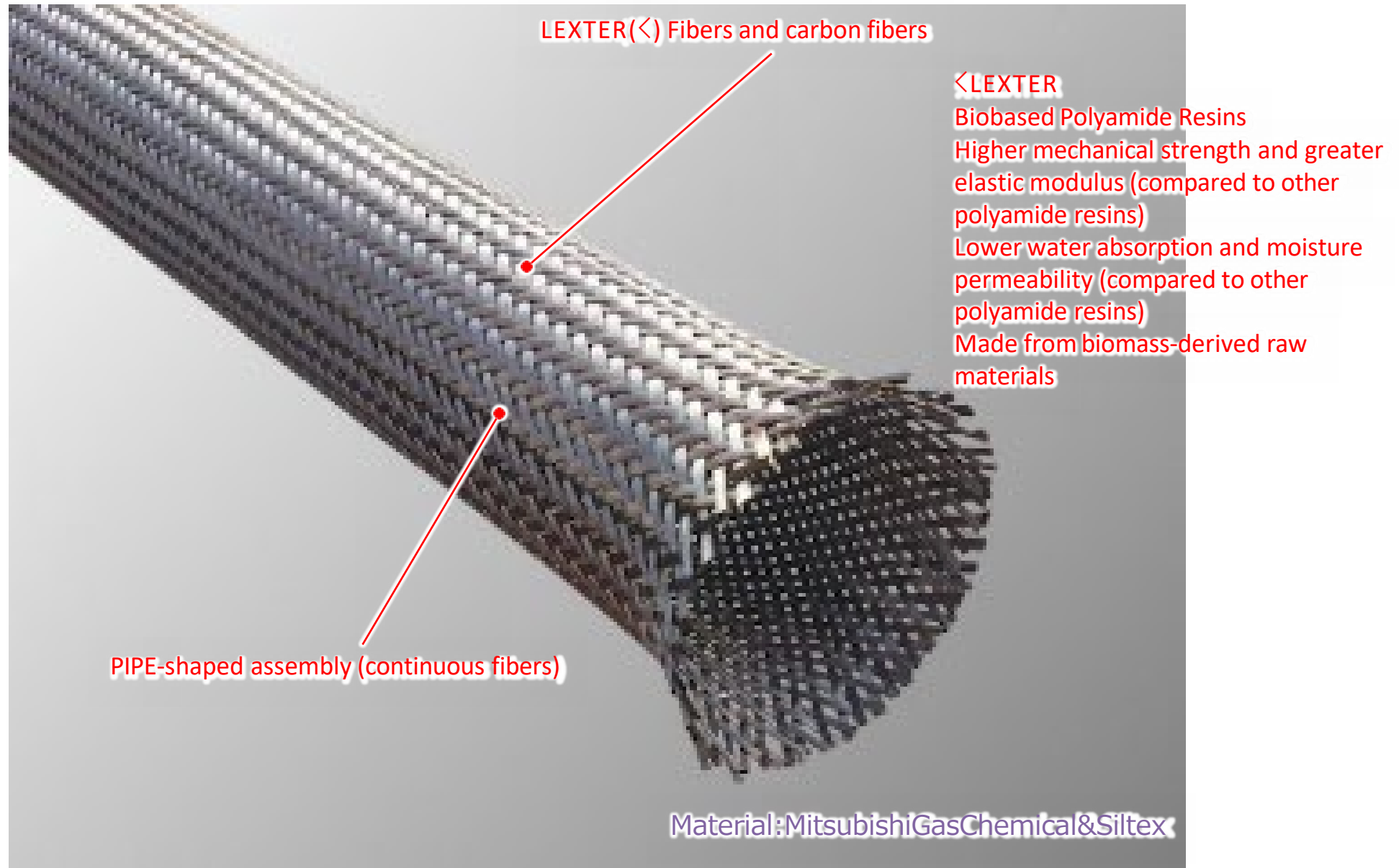
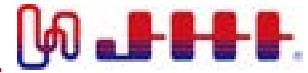
For future plans, you could consider the following:

- 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.

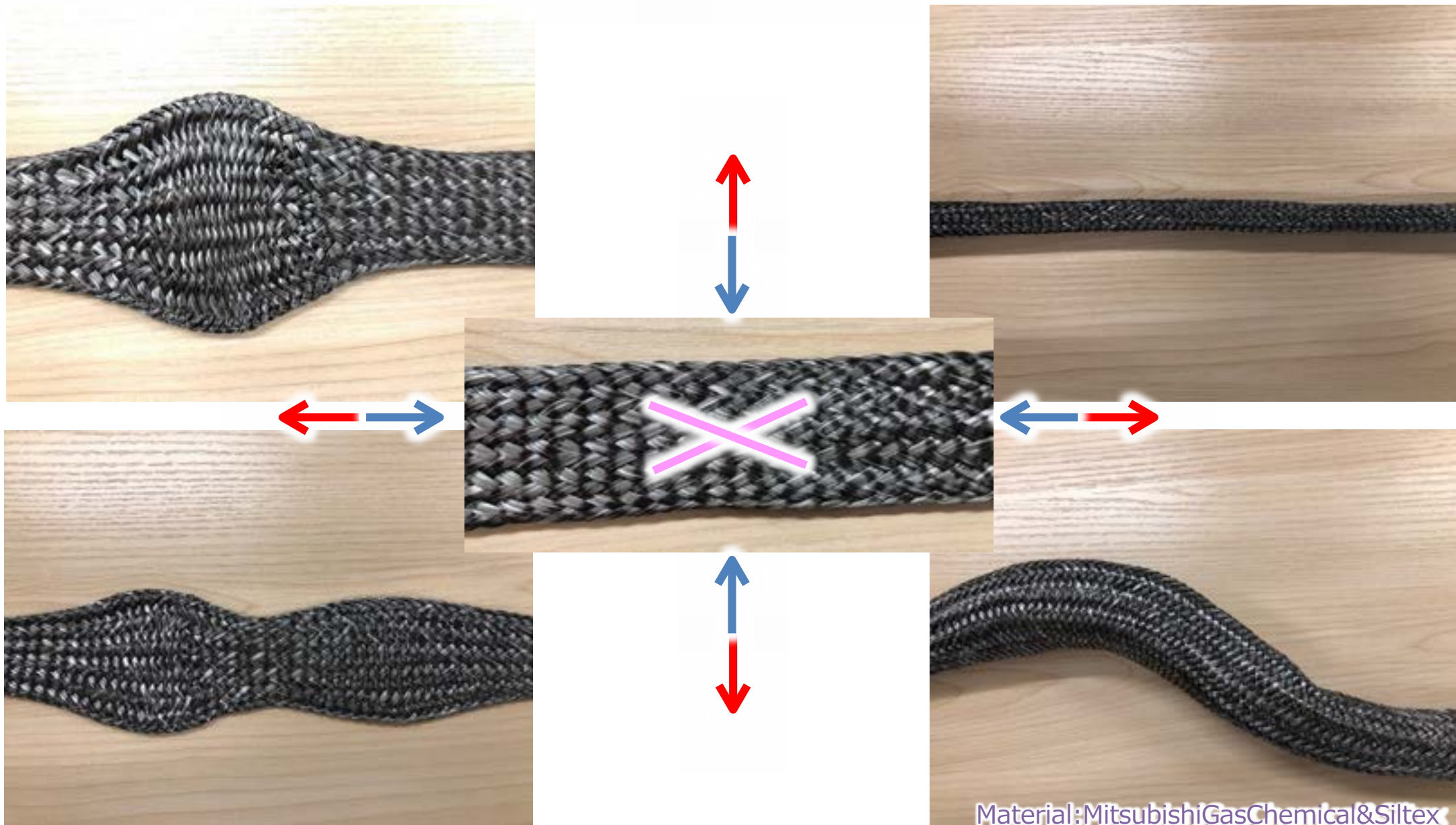
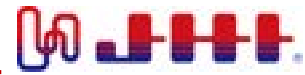
BRAIDED CFRTTP PIPE

BRAIDED CF RTP PIPE: Materials



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

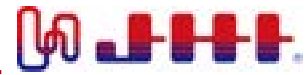
BRAIDED CFRTTP PIPE: Deform



Material: Mitsubishi Gas Chemical & Siltex

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.

BRAIDED CFRTTP PIPE: Mold



Material: Mitsubishi Gas Chemical & 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.

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.)

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.

Thank You!

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