Application of CFRTP High-Cycle Manufacturing Method for Mass-Produced Lightweight parts

Composite Highway Award 2024

2025/1/16

Company Profile

In 1981, members who had been active in Dome came to the Kanto region and established Tokyo R&D.Today, the company is a group company consisting of Tokyo R&D for vehicle development, PUES for EV development, and JHI for composite parts development. JHI has been developing composite parts mainly for racing vehicles since 1981, and lightweight and compact metal piping mainly for racing vehicles such as titanium since 2015. Composite material development includes design, analysis, manufacturing, and processing of CFRP parts, mainly autoclave molding (JHI owns 8 units). We have been participating in Composites United since last year. Today, we would like to introduce our recent focus on the application of CFRTP high-cycle manufacturing method to mass-produced lightweight parts.CFRTP high-cycle manufacturing method for lightweight parts in mass production.

FunaKo Office (Composite Materials Development)
151 FunaKo, Atsugi-shi, Kanagawa
We will be relocating this summer and adding new facilities.

Yokohama Office (Metal Piping Development)
4415-2, Shinyoshidamachi, Kohoku-ku,
Yokohama City, Kanagawa

CFRTP high-cycle manufacturing method

Prepreg autoclave molding (CFRP)

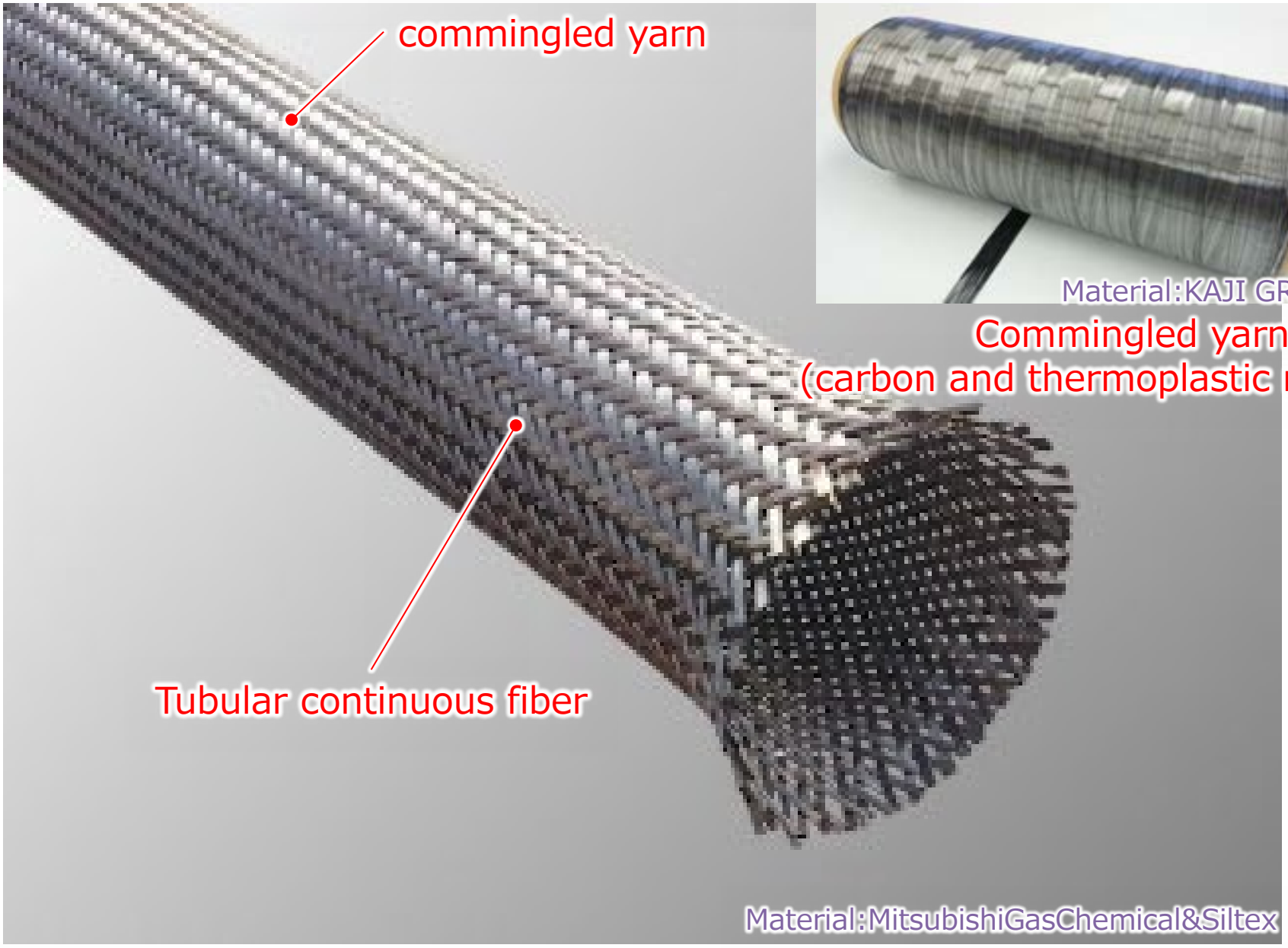
Molding time (from material cutting to demolding): approx. 300 min.

Commingled braids internal pressure molding (CFRTP)

Molding time (from material cutting to demolding): Approx. 15 min.

By optimizing the cure-cycle and molding process
We aim to achieve a molding time of 5 minutes.

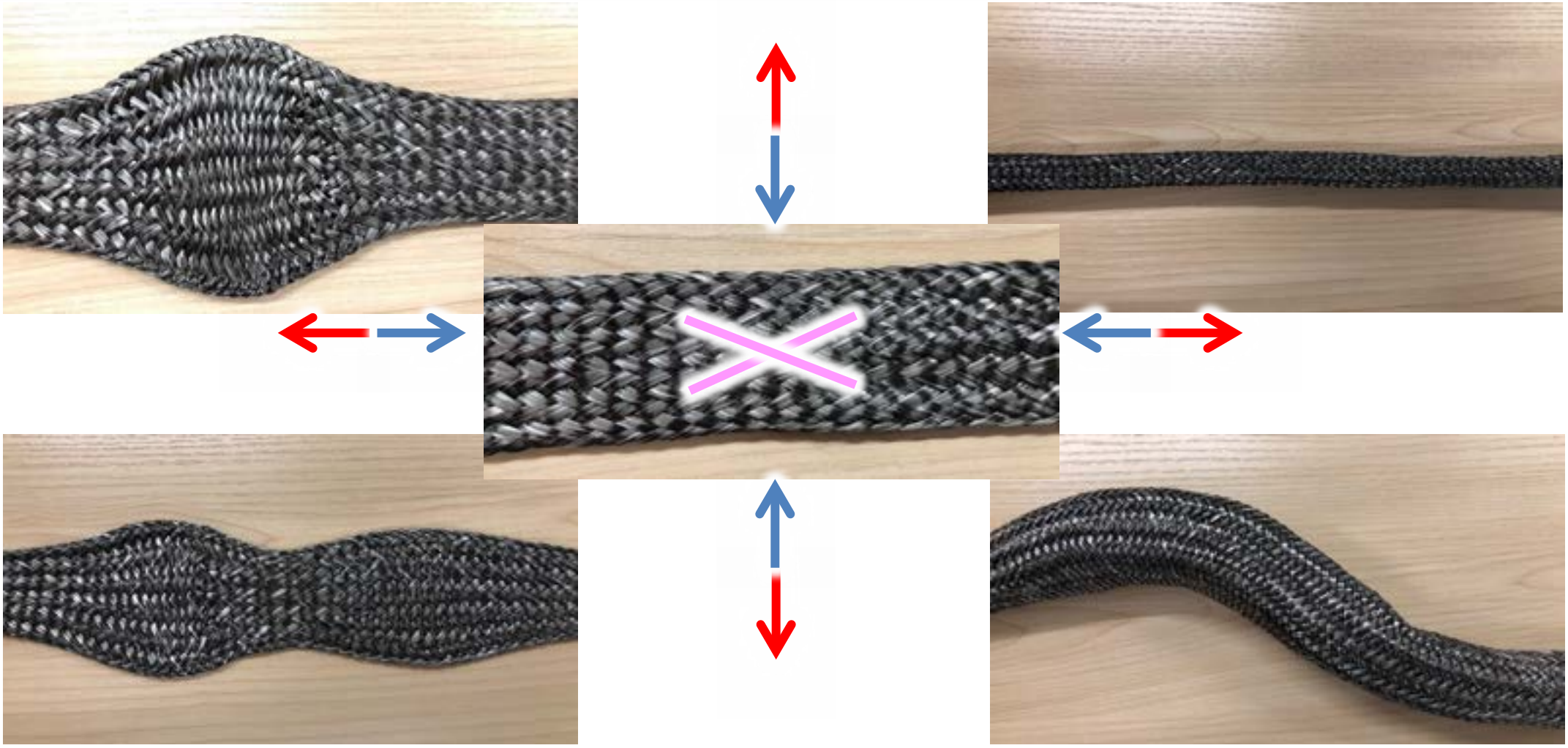
Features of commingled braids ①



Commingled yarn
(carbon and thermoplastic resin fiber)

By assembling commingled yarns, no separate resin injection is required as in RTM molding.

Features of commingled braids ②

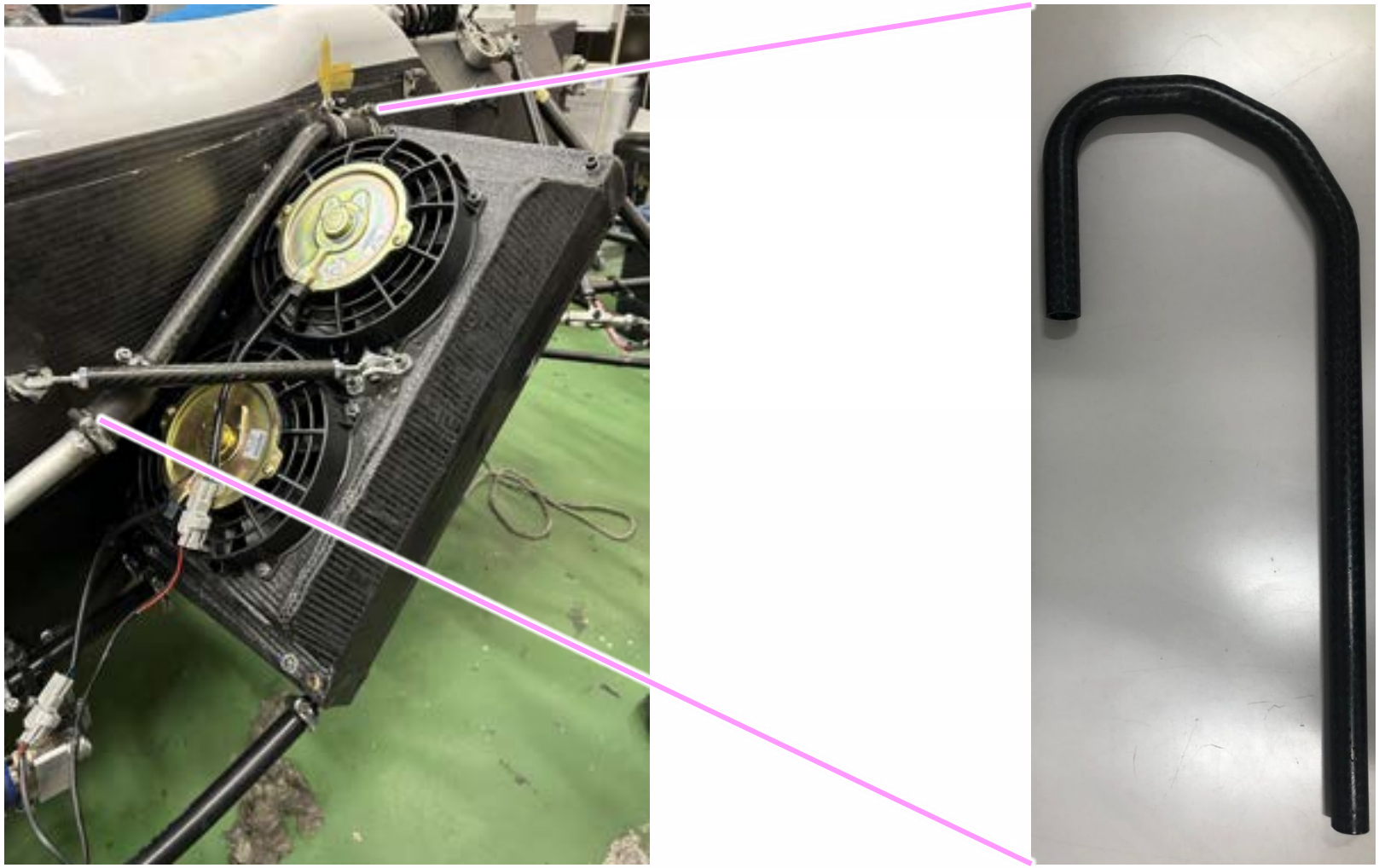


By bias-assembling in the axial direction, the material can be deformed into various shapes through expansion and contraction in the axial and radial directions and by changing the fiber crossing angles.

Features of commingled braids ③

Formable in shape according to the mold by pressurizing and heating in rough material arrangement.
In addition, there is no reduction in strength and rigidity due to fiber breakup.

Application of commingled braids prototype to piping



The parts was adopted for use in the 2024 Student Formula and Kyoto University vehicle cooling pipes and completed the race without any problems.

Issues and countermeasures for cooling piping of commingled braids

Leakage countermeasures:

pinholes → appropriate amount of resin, densification of carbon fiber, multi-layering

Smoothing of inner surface:

Change of internal pressure-applying material → change from bagging film to rubber tube

Weight reduction:

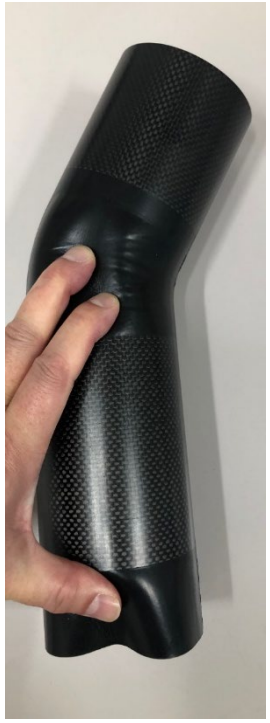
24k and 12k materials → thinner walls by applying 3k and 6k materials

Combination of 2 hosebands through rubber hose → Reduction of 1 hoseband by integration of comigled braids and rubber

Evaluation:

Leakage and burst evaluation considering operating temperature and pressure → Evaluation planned with countermeasure

Issues and countermeasures for cooling piping of commingled braids



Partial rubber application

Non-mechanical hinge

Heat Strain Absorbing Zone

We have received inquiries for mass production of cooling pipes from the overseas automotive industry, and we are aiming to receive orders for trial production and evaluation first. We are also receiving interest from domestic and foreign automotive and aerospace industries.

Application of commingled braids to structural and functional parts

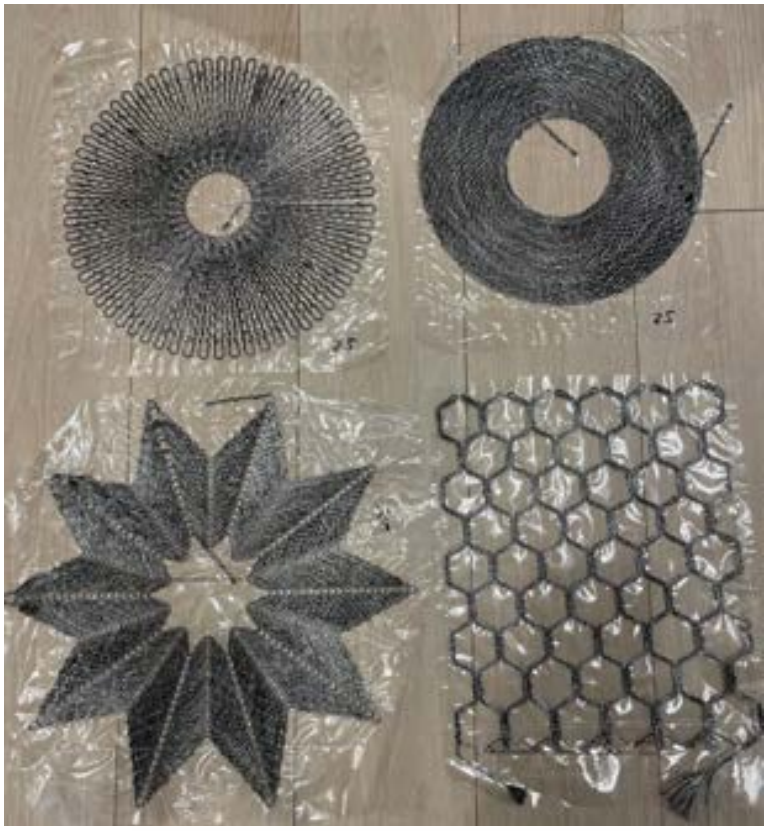
torsion test piece

Compression test results
(CFRP)(with knife edge)

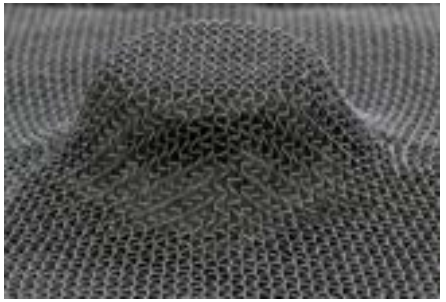
Compression test results
(CFRTP)(without knife edge)

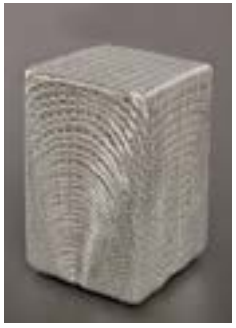
We are currently evaluating and proposing applications for shafts, energy absorbers, etc. that take advantage of the characteristics of the ±45° continuous fiber composition. Currently, we have an inquiry from the robot industry for the mass production of frames, and are currently evaluating prototypes. We also have an inquiry for joint research on energy absorbers.

Application of commingled braids to pressed parts



Combination with
commingled TFP material





Combination with
3D preform material

We plan to apply it to pressed parts by commingled braids with commingled TFP material, 3D preform material, and other materials.We have received inquiries from the aerospace industry, and are planning to make prototypes of lightweight, high-strength, and high-rigidity panels.

Example of commingled braids resin

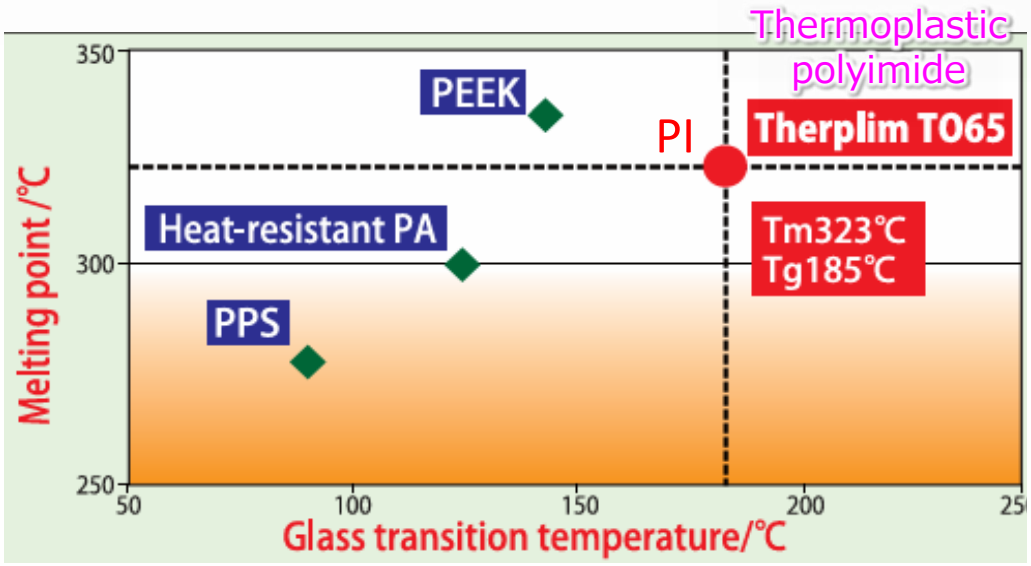


Table.Properties of LEXTER® Injection Molded Products※

item	Measurement method	unit	LEXTER® #8000	LEXTER® #8500	LEXTER® #8900	PA6	PA66
Melting point (Tm)	DSC	℃	190	215	290	220	260
Glass point transfer (Tg)	DSC	℃	60	63	75	48	50
Density	(ISO 1183)	g/cm³	1.12	1.12	1.12	1.12	1.14
Tensile strength	(ISO 527-1)	MPa	90	90	90	62	77
Tensile modulus	(ISO 527-1)	GPa	3.1	3.1	3.1	2.6	3.3
Water absorption (water immersion equilibrium/20℃)	MGC Act	%	2.5	2.5	2.5	11.5	9.9

※The above data are measured value and are not guaranteed values.

Material:MitsubishiGasChemical

	Unit	Therplim TO65
HDT	℃	170 (1.80MPa)
Relative weight	g/cm³	1.29
MFR	g/10min	6 (360℃-2.16kg)
Bending strength	MPa	120
Flexural modulus	GPa	2.6
Tensile strength	MPa	80
Water absorption rate	%	0.1 (23℃-24h)
Dielectric constant	—	2.7 (10GHz)
Dielectric tangent	—	0.004 (10GHz)
CTI	v	600
Flame resistance	—	V-2 Equivalent

※Values in the chart are representative values.

Resins can be selected from aromatic PA or thermoplastic PI,
but we can propose any resin that can be made into fiber.

In the future, we will utilize not only CFRP but also CFRTP technology to contribute to weight reduction of parts in various industries and application of mass-produced parts!

Thank you for your attention.