

AYAHA **HYBRID WOVEN** FABRIC for CFRTP/F RTP

HYBRID WOVEN FABRIC

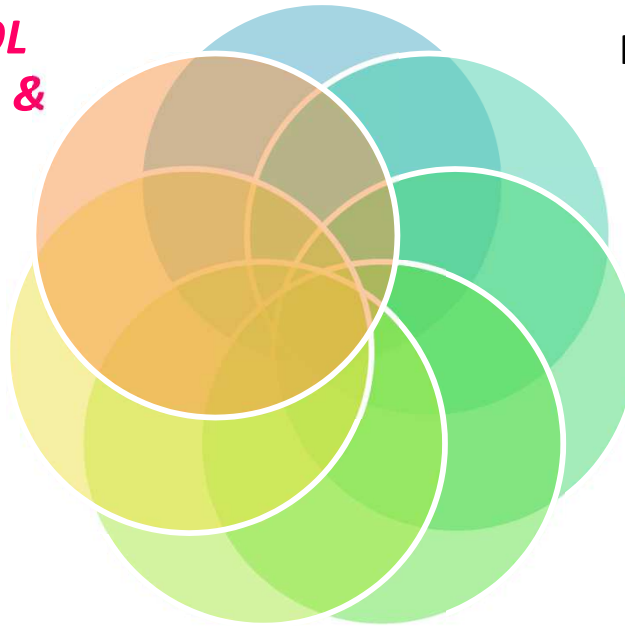
IS

Woven Materials for CFRTP/F RTP !!

For **HEAT&COOL**
COMPRESSION &
AUTOCLAVE.

For **LIGHT WEIGHT**
Composites.

FLEXIBLE and
SOFT on Roll.



EASY HANDLING for
deep and difficult shape,
and **EASY INVENTORY.**

Choose **BEST COMBINATION** for your application!

HYBRID

Reinforcement & Matrix

CARBON	PEEK	PEI	PPS
ARAMID	PC	PHENOXY	
POLYARYLATE	PA6	PA9T	PA12
BASALT	PP	PE	PLA ...
GLASS			
FLAX (Linen) ...			

WOVEN FABRIC

Hybrid Double Layer fabric

Hybrid UD fabric

Hybrid Filament fabric

AYAHA HYBRID WOVEN FABRIC for CFRTP/F RTP

AYAHA moldable HYBRID WOVEN FABRIC for RTP is one united fabric made of two layer of different component; continuous Carbon fiber (or Aramid, Polyarylate, Basalt, Glass, or Flax) as reinforcement and thermoplastic yarn as matrix, for CFRTP (RTP).

It aims, only by heat compression in the mold, for both the impregnation of matrix resin into Carbon Fiber (or other yarns) and the shaping of CFRTP at the same time.

【Characteristics】

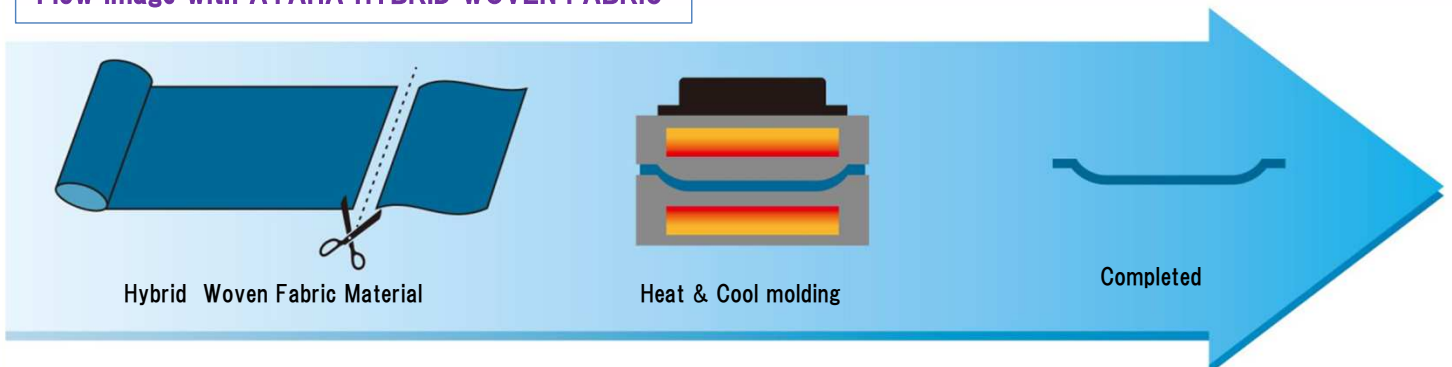
- ① Flexible and soft material, and easily molded into the deep and difficult shape.
- ② Possible to cut necessary length by scissors easily .
- ③ Package of this material is on roll, which is suitable for continuous production system.

※ This material is designed for heat-compression molding, or autoclave.

※ Heat shrinkage of matrix filament and carbon fiber filament is different, and the material should be pressed with certain power during heating process.

【Comparison of CFRTP molding process】

Flow image with AYAHA HYBRID WOVEN FABRIC

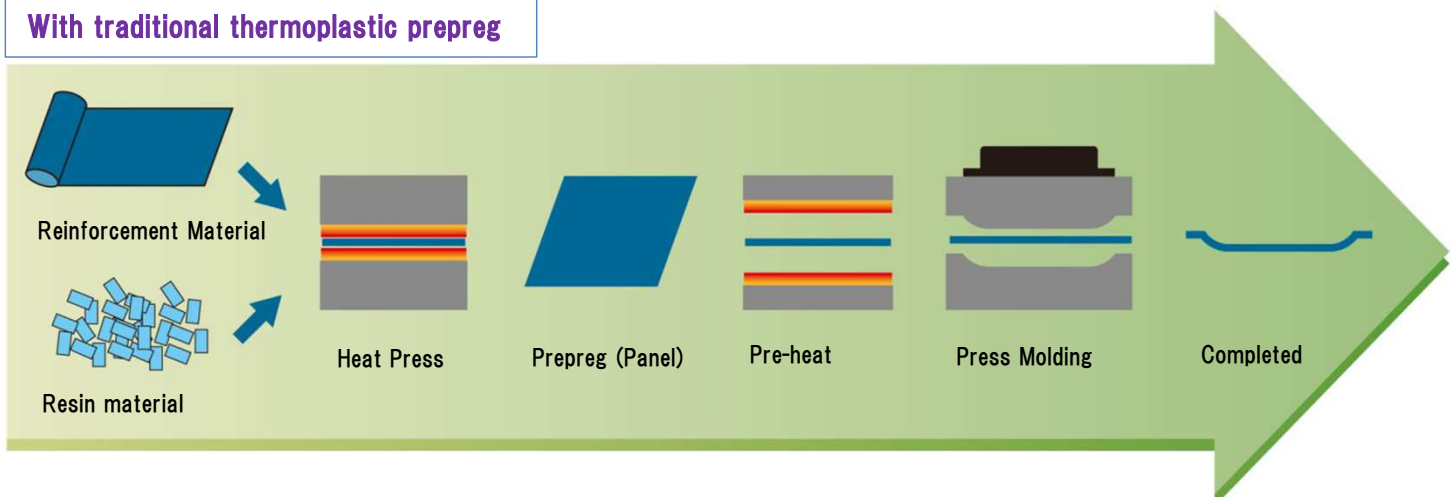


Merit ①
Easy cutting of material

Merit ②
No pre-heat necessary
→ Easy process

Merit ③
Flexible, and easy for molding deep and difficult shape.

With traditional thermoplastic prepreg



※ As for other reinforcement yarn and/or matrix yarn, please contact us.

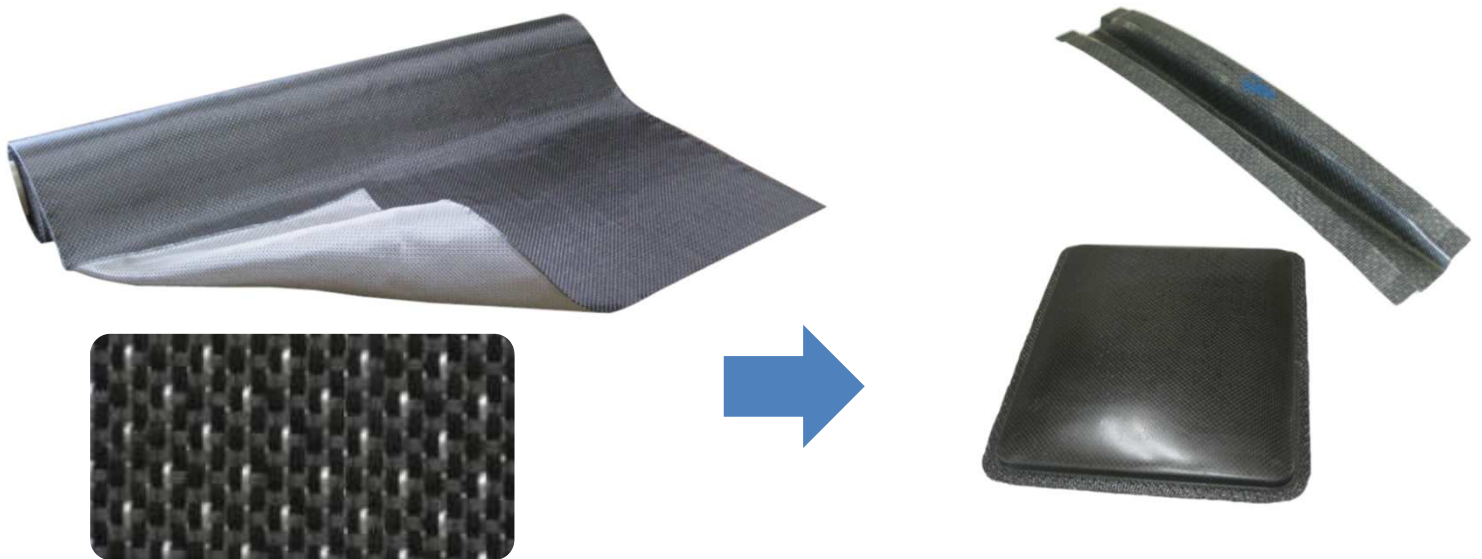
AYAHA HYBRID WOVEN FABRIC for CFRTP/F RTP

HBDL (Hybrid Double Layer Woven)

Reinforcement: Carbon Fiber(PAN), Aramid, Polyarylate, Flax(Linen) , Basalt, Glass, etc.
 Matrix: PA6, PA12, PA9T, PEEK, PEI, PPS, PC, Phenoxy, PP, PE or other thermoplastic fibers.

HBDL looks two sheets of fabric material, but is united with one fabric made of continuous Carbon Fiber (or Glass, Aramid, Flax, etc.) as reinforcement and thermoplastic filament as matrix for CFRTP.

Vf ratio (reinforcement and matrix) can be modified, by the design of weaving structure and matrix yarn selection.

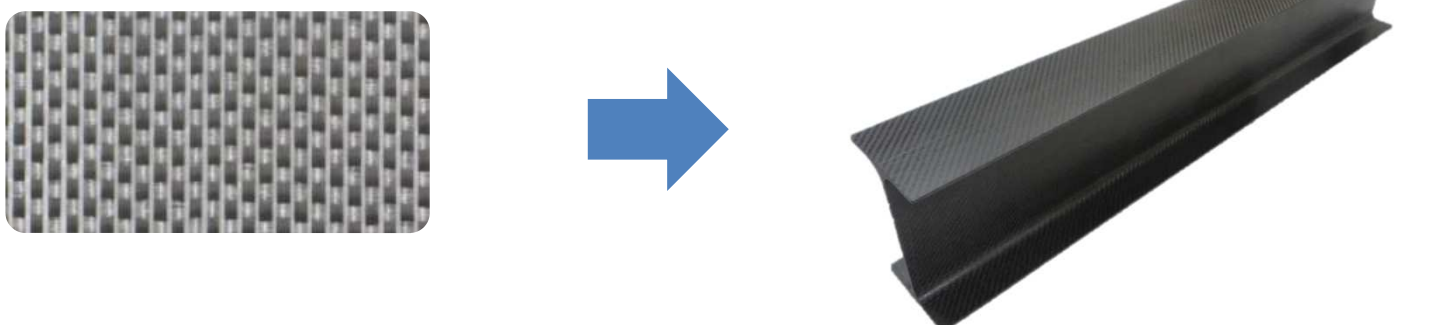


HB-UD (Hybrid UD) → HB SL-UD & HBDL-UD

Reinforcement: Carbon Fiber, Aramid, Polyarylate, Flax(Linen) , Basalt, Glass, etc.
 Matrix: PA6, PA12, PA9T, PEEK, PEI, PPS, PC, Phenoxy, PP, PE or other thermoplastic fibers.

Carbon fiber, Para-Aramid, H.T.Polyarylate and Basalt etc. can be woven into UD (Uni-directional) fabric for CFRTP.

Single Layer structure (HB SL-UD) and Double layer structure (HBDL-UD) are available. HB-UD is simple woven fabric, but it can give materials specific directionality in case of laminated molding.



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HYBRID DOUBLE LAYER WOVEN for COMPOSITES **NATURAL FLAX YARN & THERMOPLASTIC YARN**

HBDL FYPLA T-701 **FLAX YARN & PLA YARN**

Hybrid woven fabric, made of natural FLAX yarn as a reinforcement, and biodegradable PLA yarn as matrix.
Both are **carbon-neutral** and **nature-friendly** materials.

HBDL FYPP T-701 **FLAX YARN & PP YARN**

Hybrid woven fabric, made of natural FLAX yarn as a reinforcement, and low density general-purpose PP yarn as matrix.
It is a material aiming to both **carbon-neutral** and **light-weight**.



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Hybrid Filament Fabric (HBFIL)

Hybrid filament fabric is woven from special hybrid filament yarn made of two materials with different melting points.

By proper thermoforming this hybrid filament fabric in the mold, resin with a lower melting point in the yarn melt into a matrix, and resin with a higher melting points remains as reinforcement yarn. This is a developed product aimed at creating FRTP products that express the resin properties of matrix and the physical properties of reinforcement including mechanical strength.

There are the following combinations.

Glass roving & PP

GF & PP

Glass roving & PA6

GF & PA6

Carbon fiber & Phenoxy

CF & PX

Polypropylene & Polyethylene

PP & PE

Polyester & Low-melting-point polyester **PET & CoPET**



AYAHA **HYBRID WOVEN FABRIC** for CFRTP/F RTP

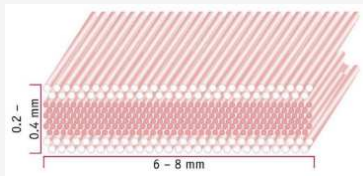
Hybrid Filament Fabric (HBFIL)

【GF & PP】

Glass Roving & Polypropylene

【GF & PA6】

Glass Roving & PA6

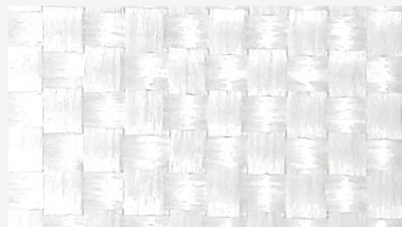


- Glass Roving
- Thermoplastic Multifilament Fibers

Cross section image*

Special flat shaped hybrid filaments consisting of glass roving inside and PP (or PA6) filament outside, is made into woven fabrics, without twist, of plain, twill, or double layer weave.

This fabric shows good impregnation properties and can be thermoformed in a short time.



GF & PP type is a "stampable fabric", which has strength of glass roving, lightweight property of polypropylene, and flexibility of woven fabric. Thermoforming with approx. 200~220°C temperature is required.



GF & PA6 type is has better heat resistance. Thermoforming with approx. 220~240°C temperature is required.

Glass roving & PP

- | | |
|-------------------|-------------|
| HBFIL GF&PP T-201 | plain weave |
| HBFIL GF&PP T-202 | twill weave |

Glass roving & PA6

- | | |
|-------------------|-------------|
| HBFIL GF&PA T-201 | plain weave |
| HBFIL GF&PA T-202 | twill weave |



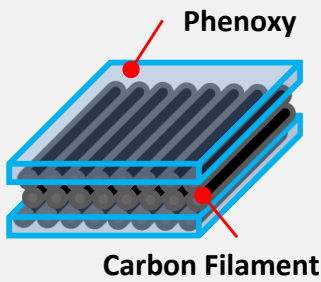
* Graphic with courtesy of PHP Fibers

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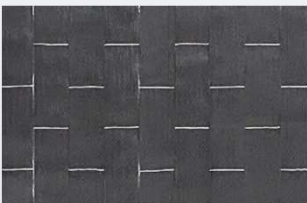
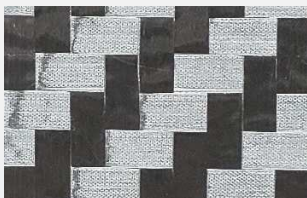
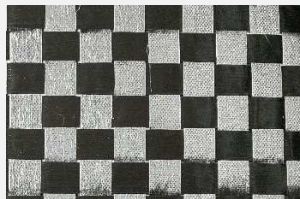
Hybrid Filament Fabric (HBFIL)

【CF & PX】

Carbon & Phenoxy (Thermoplastic epoxy)



Cross section image

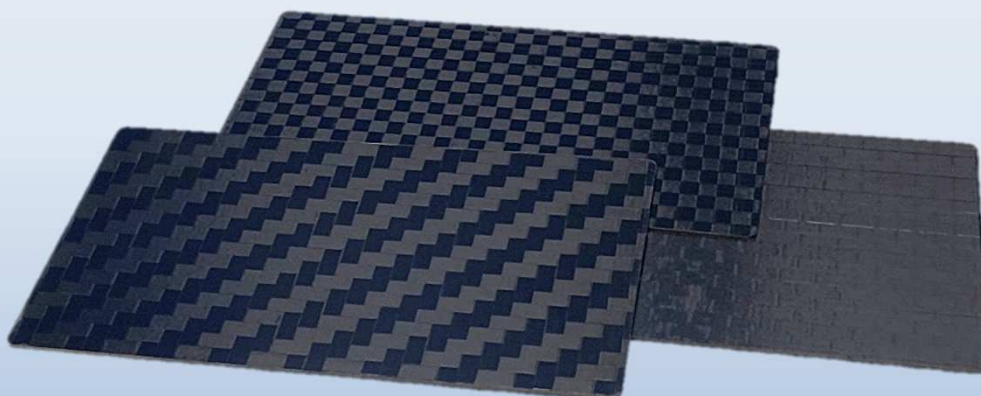


Special flat commingled hybrid filament yarn consisting of 12K carbon fiber and phenoxy yarn is, without twist, made into woven fabric of plain, twill weave, and UD sheet.

The combination of highly fluid and amorphous phenoxy resin and 12K carbon fiber enables good impregnation in a short time by thermoforming. For thermoforming, approx. 220~240°C temperature is required.

(Phenoxy resin, as matrix, is a non-crystalline resin with a Tg point of 84 °C, which is used as an adhesive and is also called a thermoplastic epoxy.)

HBFIL	CF&PX	T-091	plain weave
HBFIL	CF&PX	T-092	twill weave
HBFIL-UD	CF&PX	T-093	UD

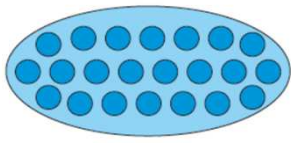


AYAHA HYBRID WOVEN FABRIC for CFRTP/F RTP

Hybrid Filament Fabric (HBFIL)

【PP & PE】

Polypropylene & Polyethylene



● PP
 ■ PE

Cross section image

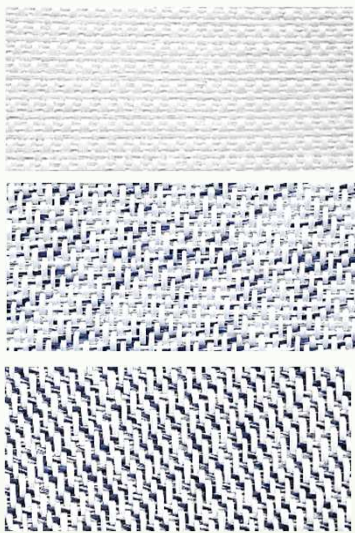
Special flat shape hybrid monofilaments with high tensile PP on the core (inside) and low melting point PE on the sheath (outside), are made into double layer woven fabric.

It has higher strength and higher modulus than general olefin fibers, and by thermoforming you will get the product with good impact resistance.

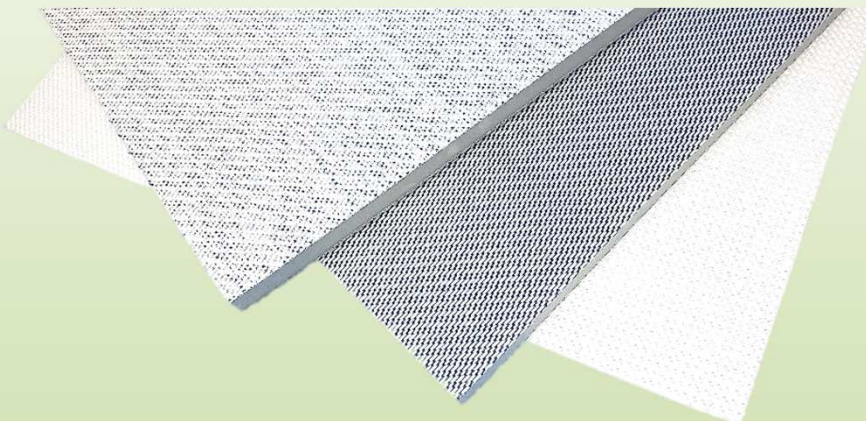
Lightweight material with density of 0.9. For thermoforming approx. 140°C temperature is required.

(Melting point: core 165°C, sheath 120°C)

Color designed fabric is available by inserting colored yarn.



HBFIL	PP&PE	T-DL400			double layer weave
HBFIL	PP&PE	T-DL540	BL02	Blue	double layer weave
HBFIL	PP&PE	T-DL500	BL04	Blue	double layer weave

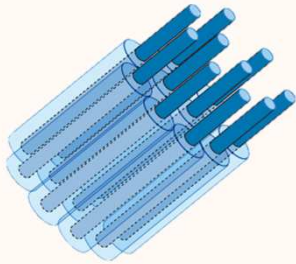


AYAHA HYBRID WOVEN FABRIC for CFRTP/F RTP

Hybrid Filament Fabric (HBFIL)

【PET & CoPET】

Polyester & Low-melting-point Polyester



- PET
- CoPET

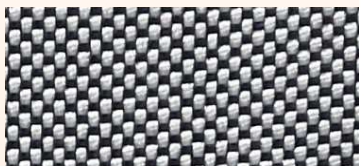
Cross section image

High-performance hybrid multi filaments, with high viscosity polyester on the core (inside) and low-melting-point polyester on the sheath (outside), are made into woven fabrics of plain, twill, or double layer weave.

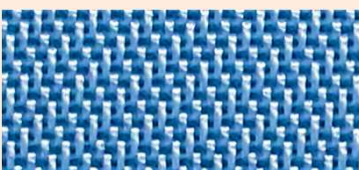
By thermoforming, it is possible to perform three-dimensional molding that has both higher rigidity and modulus than general polyester.

For thermoforming approx. 180~190°C temperature is required.
(Melting point: core 250 °C, sheath 180 °C)

Colored fabric is available by adding colored yarn.



Single Layer



Double Layer

HBFIL PET&CoPET T-800	single layer weave, white
HBFIL PET&CoPET T-8CX	single layer weave, color
HBFIL PET&CoPET T-DL800	double layer weave, white
HBFIL PET&CoPET T-DL8CX	double layer weave, color

(Color code: X = 0: white 1: Yellow 2: Red 3: cyan blue 4: black
※ other color is also available)