



We are supporting global environment protection of an enterprise through quality improvement of thermophysical property measurement.



Since we can evaluate the fiber orientation inside the CFRP structural parts, we can use it especially in the "development site of electric cars and quality control", "development site of fiber plastic manufacturer".

### ■ Specifications

Name		Thermal Evaluation of Fiber Orientation Distribution
Basic Function	Measurement object	Thermal diffusivity, It is possible to grasp the fiber state in the sample. (orientation of fibers, dispersion of fibers), distribution
	Measurement time	About 1 minute / point
Accessories	Analysis software	○
	PC	○
Measurement environment	Temperature	Room temperature
	Measurement frequency	0.01 [Hz] ~
Laser diode	Wavelength	638 [nm]
	Output max	0.4 [W]
Radiation thermometer	Element	InSb
	Cooling method	Electronic cooling
Stage displacement	Sample stage	100 × 200 [mm]
Power supply		AC 100 [V], 50/60 [Hz], 5 [A]
Usage environment	Temperature	10 ~ 40 [°C]
Terms of use	Sample	CFR(T)P, GFRP, Nanocellose, Filler filled resin, etc
	Shape	Any shape
	Surface	Sampe substrates should be flat and smooth for the best results (Thickness should be measurable)
	Coating	Not need. (Blackening treatment is required only for those that the laser transmits)
	Sample size (Max)	200 × 100 × 4 [mm]
	Sample size (Min)	30 × 10 × 0.1 [mm]
Main body	Dimensions	W710 × D710 × H576 [mm]
	Weight	60 [kg]

- The numbers shown in this catalog are results from our examination. The same results are not guaranteed in different circumstances.
- The performance and appearance may be changed for improvement without notice.
- For delivery date and prices, please contact our dealer. We will submit quotation separately.
- For those who are considering purchasing of our equipment, trial measurements are carried out. Please feel free to tell us. (If you have many samples, you may be charged separately.)

### ⚠ Caution for Safety

Before using, please read manual and operate correctly for the safety.

We wish to contribute to technological innovation and creating the future through our thermal measurement technology.



Orientation identification method

## Thermal Evaluation of FOD (Fiber Orientation Distribution)

BETHEL

Evaluate the internal structure of CFRP and GFRP by heat  
Quantify fiber orientation and thermal diffusivity at high speed and non-contact !!



open price



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# Thermal Evaluation of FOD



## FEATURES

- Applicable to nondestructive and complicated shape products!
- Speedy measurement at 1 point per minute!
- Quantify fiber orientation and thermal diffusivity!
- Even large ones can be measured!

Nondestructive / quick / quantitative (orientation, thermal diffusivity)

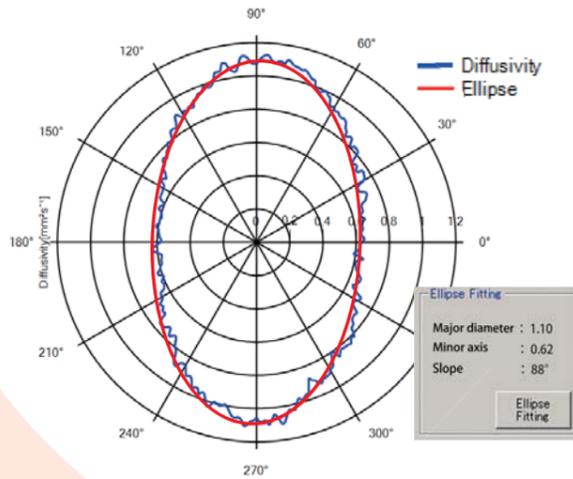
It is possible to grasp the internal fiber state (relative orientation of fibers, relative amount of fibers, dispersion of fibers) of carbon fiber plastic, glass fiber reinforced plastic, nanocellulose and others. In addition, since thermal diffusivity can be measured and quantified, it can be used for evaluation and quality control during resin development.

## THEORY

Spot heating the sample with the laser and measure the heat transfer!

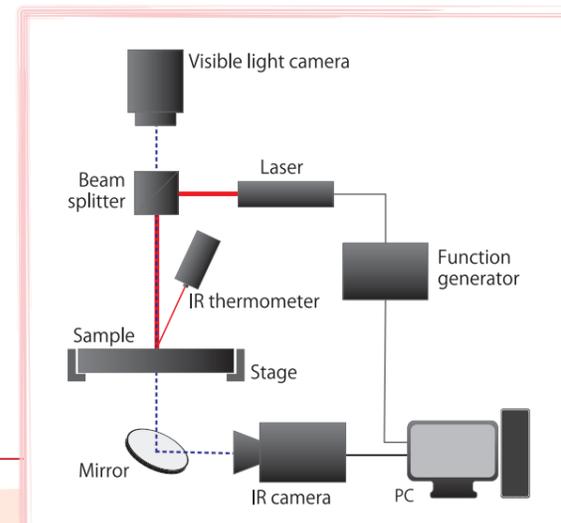
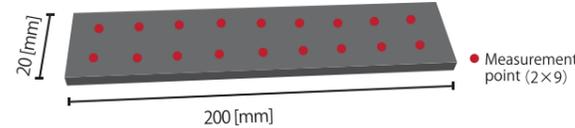
### ■ Orientation identification method

A method of applying in-plane thermal diffusivity angle distribution measurement. The speed of heat transfer (thermal diffusivity) differs depending on the fiber content and orientation. Therefore it becomes possible to clarify the fiber orientation distribution by measuring the thermal diffusivity in all directions.



### <Measurement sample (standard)>

Sample size : a strip sample of 200 × 20 [mm]  
Number of measurement points : 18 points (2 × 9)



## CONFIGURATION

A system that visualizes the fiber state (main orientation angle / dispersion) inside the sample by "fiber orientation identification method"

## APPLICATION

### Application example of CFRTP ①

#### Fiber orientation of dumbbell-shaped CFRTP sample

This is a sample in which resin was poured from both sides of the sample. It is used when you want to observe where the resins collide at the center part.

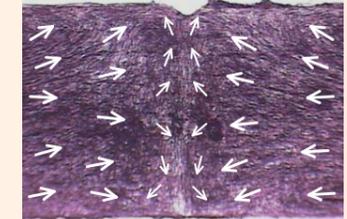


In the colliding part of the resin, what direction is the fiber oriented?



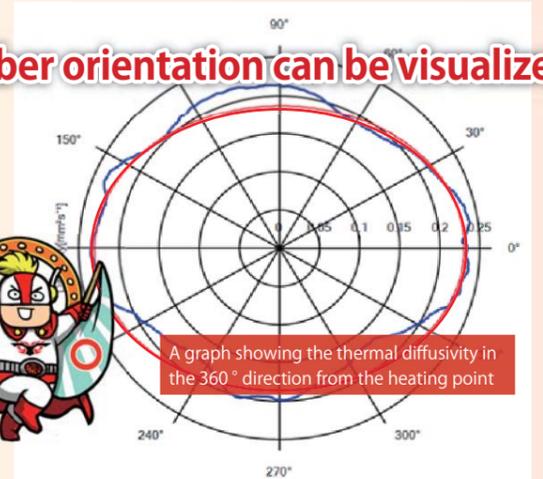
Quantification

(Reference) Optical camera image



The arrow in the above figure shows a fiber orientation image

Fiber orientation can be visualized.

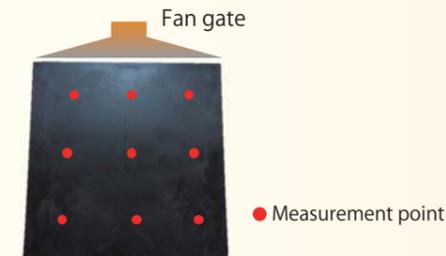


A graph showing the thermal diffusivity in the 360° direction from the heating point

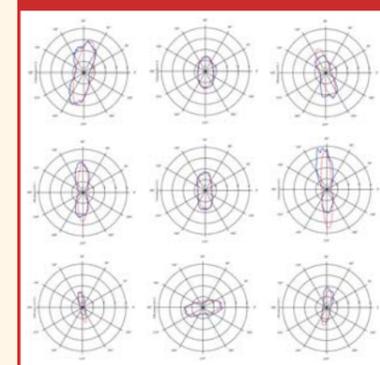
### Application example of CFRTP ②

#### Distribution of fiber orientation of CFRTP sample at the time of flow state of resin in injection molding

When such an observation is required as to how the fiber is oriented in each part, it depends on the flow state of the resin at the time of injection molding.



#### Fiber orientation within the sample



Measure in details

#### ■ Fiber orientation within the sample



#### Features of orientation identification technology

Nondestructive / quick / quantitative (orientation, thermal diffusivity)

#### What can it be done?

You can see the fiber orientation of CFRTP structural parts!

#### Anticipated applications

For development sites and quality control of electric vehicles  
For the development site of resin manufacturers

