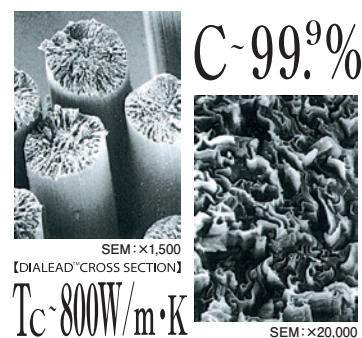


## DIALEAD™

Mitsubishi Rayon Co.,LTD. has developed a high performance pitch-based carbon fiber 《DIALEAD™》, which is available in a large range of product formats, from low modulus to ultra high modulus grades. 《DIALEAD™》 is recognised worldwide as a composite material which gives big advantages for numerous applications.

## PERFORMANCE

- High Purity
- High and Ultra High Modulus
- High Thermal Conductivity
- Excellent Handling Characteristics
- Proven Cost Advantage



## GRADE

### ■ 《DIALEAD™》 STANDARD GRADE

	Grade [Unit]	Tensile Modulus [GPa]	Tensile Strength [MPa]	Elongation [%]	Density [g/cm <sup>3</sup> ]	Yield [g/1000m]	Thermal Conductivity [W/m·K]	ER [μΩm]
Continuous Fiber (2K, 6K Type)	K1352U	620	3600	0.6	2.12	270	140	6.6
	K1392U	760	3700	0.5	2.15	270	210	5.0
	K13C2U	900	3800	0.4	2.20	275	620	1.9
	K13C6U	900	3600	0.4	2.18	760	580	2.0
	K13D2U	935	3700	0.4	2.20	365	800	1.5
Continuous Fiber (12K, 16K Type)	K13312	420	3200	0.7	2.05	1550	110	8.0
	K63712	640	2600	0.4	2.12	2000	140	6.6
	K13916	760	3000	0.4	2.15	2200	200	5.1
	K63A12	785	2600	0.3	2.15	1950	220	4.7
Chopped Fiber	K223Y1	50	1000	1.8	1.5	—	—	—
	K223SE	185	2350	1.1	2.0	—	—	—
	K223HE	900	3800	0.3	2.2	—	550	—
	K6371T	640	2600	0.4	2.1	—	140	—
Milled Fiber	K223HM	900	3800	—	2.2	—	550	—
	K6371M	640	2600	—	2.1	—	140	—



## Continuous Fiber

《DIALEAD™》 fibers are offered in a wide range of modulus levels, having excellent laminate properties.

### Laminate Properties (2K, 6K)

Style : Uni-directional [0]t Resin : 350°F Cure Epoxy

			K1352U	K1392U	K13C2U	K13C6U *	K13D2U
Longitudinal	Tensile	Strength [MPa]	2000	2100	2200	2000	1800
		Modulus [GPa]	380	460	560	550	560
	Compressive	Strength [MPa]	450	400	380	340	340
		Modulus [GPa]	250	420	560	550	560
	ILSS	[MPa]	75	70	50	50	40
CTE (Temp. 50~125°C)	[×10 <sup>-6</sup> /K]	-1.1	-1.2	-1.2	-1.2	-1.2	
Transverse	Tensile	Strength [MPa]	40	35	30	20	25
		Modulus [GPa]	6.0	6.0	5.5	5.0	5.0

Data are average results of experiments made on standard procedures and subject to normal manufacturing variation.  
Tensile and compressive data normalized by 60% Fiber Volume.  
\*Resin : 250°F Cure Epoxy

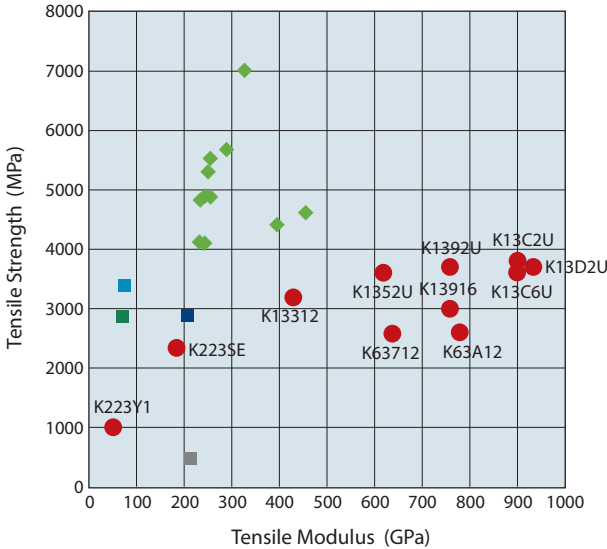
### Laminate Properties (12K, 16K)

Style : Uni-directional [0]t Resin : 250°F Cure Epoxy

			K13312	K63712	K13916	K63A12
Longitudinal	Tensile	Strength [MPa]	1700	1500	1700	1500
		Modulus [GPa]	230	370	460	470
	Compressive	Strength [MPa]	540	440	360	380
		Modulus [GPa]	160	330	430	470
	ILSS	[MPa]	70	75	70	70
CTE (Temp. 50~125°C)	[×10 <sup>-6</sup> /K]	—	-1.1	-1.2	-1.2	
Transverse	Tensile	Strength [MPa]	30	35	25	25
		Modulus [GPa]	6.0	5.5	5.0	5.0

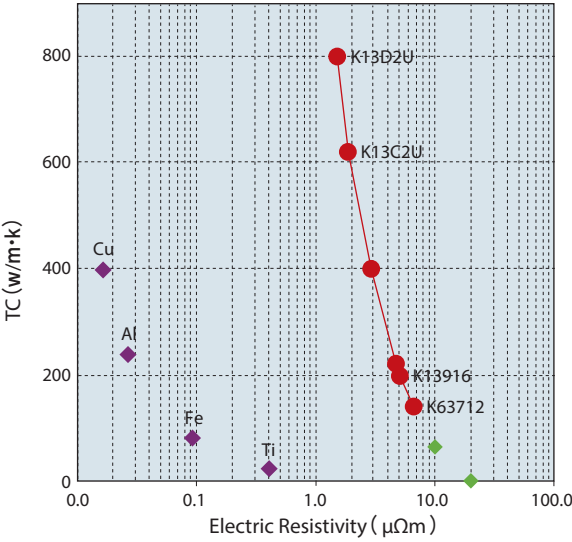
Data are average results of experiments made on standard procedures and subject to normal manufacturing variation.  
Tensile and compressive data normalized by 60% Fiber Volume.

### Tensile Modulus and Strength



● 《DIALEAD™》    ◆ PAN based CF \*    ■ Glass Fiber  
■ Sic Fiber    ■ Aramid Fiber    ■ Steel  
\*Mitsubishi Rayon Co.,Ltd. PYROFIL™

### Thermal Conductivity and Electric Resistivity



● 《DIALEAD™》    ◆ PAN based CF    ◆ METAL



## Chopped Fiber

《DIALEAD™》 chopped fiber offers excellent purity and high performance. Our chopped fibers are available in a variety of grades to meet the demands of numerous applications.

### Fiber Properties

Grade	Bulk Properties				Filament properties					
	Length [mm]	Bulk Density [g/l]	Shape	Sizing Amount [%]	Filament Diameter [μm]	T.C. [W/m · K]	Tensile Modulus [GPa]	Tensile Strength [MPa]	Elongation [%]	Density [g/cm <sup>3</sup> ]
K223Y1	6	>330	Round	2-4	13	<5	50	1000	1.8	1.5
K223SE	6	>430	Round	3-5	11	20	185	2350	1.1	2.0
K223HE	6	>400	Round	0	11	550	900	3800	0.3	2.2
K6371T	6	—	Flat	1-3	11	140	640	2600	0.4	2.1

This information can be used for material selection only.

## Milled Fiber

《DIALEAD™》 milled fibers are available. Offered in a range of modulus levels, retaining properties which allow users to achieve high performance

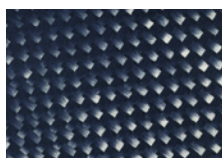
Grade	Fiber Length [μm]	T. Strength [MPa]	T. Modulus [GPa]	Sizing [%]
K223HM	50/200μm	3800	900	non
K6371M	50μm	2600	640	1-3

This information can be used for material selection only.



## Fabric

Numerous areal weights and weave styles are available.



### Typical Fabric

Grade	Style	FAW[g/m <sup>2</sup> ]	《DIALEAD™》 Grade
FT37Y960	Twill	960	K63712
F637400	UD-Fabric	400	K63712

### Typical Prepreg

Grade	FAW[g/m <sup>2</sup> ]	《DIALEAD™》 Grade	Resin system
HyEJ34M65 PD	340	K63712	125°C Cure Type
HyEJ34M65 PDHX1	340	K63712	180°C Cure Type
HyEJ28M80QD	280	K13916	125°C Cure Type

This information can be used for material selection only.

## 《DIALEAD™》 PACKAGE

### ● Continuous Fiber

Grade	Length [m]	Typical Weight [kg/ Spool]	Sizing [code]	Carton [No. of Spool]
K1352U	*730	0.2	P	25
K1392U	*730	0.2	P	25
K13C2U	*380	0.1	P	25
	*750	0.2	P	25
K13D2U	*280	0.1	P	25

\*Controlled by weight

Grade	Typical Length [m]	Weight [kg/ Spool]	Sizing [code]	Carton [No. of Spool]
K13312	1250	*2.0	R	9
K63712	1250	*2.5	R	9
K13916	1250	*2.8	R	9
K63A12	600	*1.2	R	16
K13C6U	250	*0.2	R	25

\*Controlled by length

### Core Size

I.D. [mm]	76.5
O.D. [mm]	82.5
Length [mm]	305
Weight [g]	170

### ● Chopped and Milled Fiber

- 10kg/Bag
- 30Bags(300kg)/Pallet



For Continuous Fiber



For Chopped and Milled Fiber

## ► Applications



"A courtesy of Simplex Aerospace" Ex) Aerial Cleaning Equipment



"A courtesy of Rexnord" Ex) Drive Shaft



©Akihiro Ikeshita / JAXA Ex) Optical Strut pipes for Solar-B

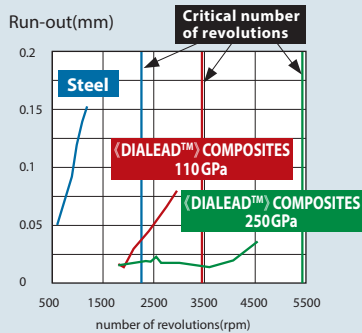


"A courtesy of MORIWAKI ENGINEERING Co., Ltd." Ex) C/C Brakes

## ► 《DIALEAD™》 Specific Application

《DIALEAD™》 COMPOSITES contribute to light weight, fast damping vibration and improvement for critical number of revolutions.

### ■ Run-out test results



### ■ Critical number of revolution calculated

Tube dimension, OD60mm / ID 50mm × 2000mmL  
(Total length is 2082mmL with iron journal parts)

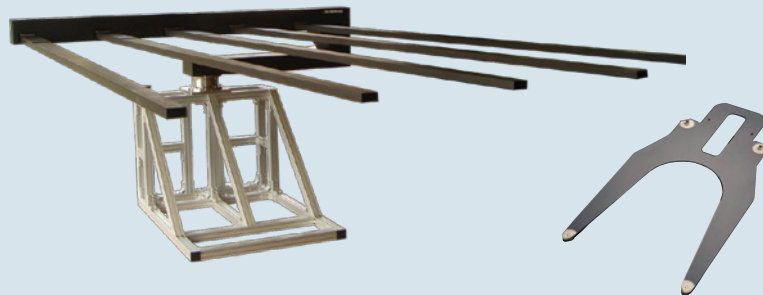
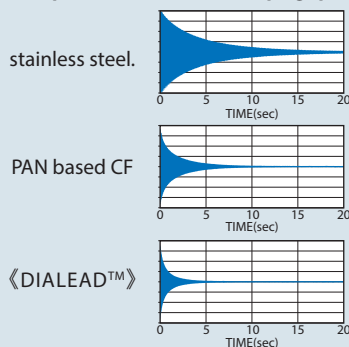
Design sample	Nominal Modulus [GPa]	Tube weight [kg] *1	Actual deflection [mm] *2	Critical number of revolution [rpm]
《DIALEAD™》 COMPOSITES	110	2.8	2.68	3440
《DIALEAD™》 COMPOSITES	250	3.0	1.12	5330
Steel	206	14.0	1.19	2260

\*1 only tube weight. The weight of journal parts is 1.5kgf

\*2 Measuring span: 2025mm, two-point support, free of both end, under uniformly distributed load by 627N.

\*The above values are not guaranteed performance but representative and calculated.

### ■ Comparison of vibration damping speed



Ex) Robot hand for G9 (94.5" x 110") Flat Panel Display transfer

Ex) Robot hand for 12" semi conductor wafer transfer



## DIALEAD Composites Department Composites Products Division

1-1-1, Marunouchi, Chiyoda-ku, Tokyo 100-8253, Japan Phone: +81-3-6748-7357 Facsimile: +81-3-3286-1341

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Sakaide Carbon Fiber Plant