MITSUBISHI CHEMICAL GROUP

MITSUBISHI CHEMICAL CORPORATION

DIALEAD™

The characteristics of DIALEAD® composites; Low Weight, High Stiffness, High Thermal Conductivity and Zero CTE are overcoming metals, and applied for many products, contributing saving energy and high productivity for sustainable world.

Aerospace

Low Weight・Zero CTE

A courtesy of Vertex GmbH

A courtesy of Space Communications Corp., Superbird-C, Japan

Industrial machine

Low Weight・High Stiffness

A courtesy of YASKAWA Corp.

A courtesy of Daimler Chrysler Aerospace, Dornier and Muller Weingarten AG

Automotive

Low Weight・High TC

A courtesy of Crompton Technology Group Ltd.

Civil Infrastructure

Low Weight・High Stiffness

Features	Application / Characteristics	Comparison
Lightweight / High stiffness	• Low bending • High-speed operation • Vibration suppression • Space saving	• About 1/4 space gravity compared with iron • About 2/3 of aluminum Stiffness and strength higher than iron • Early attenuation of vibration possible
High thermal conductivity	• Lightweight heat sink • Incombustibility • Stable performance at high temperatures	• Thermal conductivity equivalent to copper • Higher thermal conductivity realized compared with common plastic materials.
Low coefficient of thermal expansion	• Dimensional stability • High precision parts	• Excels in thermal dimensional stability • Coefficient of thermal expansion can be made to zero by composite design.

Materials Properties Comparison Table

Form	Material	Specific gravity	Tensile Elasticity	Flexural Modulus	Thermal expansion coefficient		Thermal Conductivity		Natural Frequency	Self-weight Deflection	Load deflection
					X axis	Y axis	X axis	Y axis			
		g/cm^3	GPa	GPa	10^-6/˝K	10^-6/˝K	W/$_m$,K	W/$_m$,K	Hz	mm	mm
Sheet Materials	DIALEAD Composite (105 GPa)	1.6	105	98	1.7	5.8	2.5	1.3	13.2	2.2	3.5
	DIALEAD Composite (250 GPa)	1.7	250	220	-0.9	7.7	73	1.2	19.7	1	1.5
	DIALEAD Composite (320 GPa)	1.7	320	260	-0.9	9	115	1.2	22.2	0.8	1.2
	DIALEAD Composite (Zero-CTE)	1.6	220	170	0	11	39	1	18.9	1.1	1.7
	DIALEAD C/C Composite	1.9	-	69	-1	-1	90	90	-	-	-
	SUS303	8	200	200	17.3	17.3	15	15	8	6	1.9
	Aluminum (1200H18)	2.7	69	69	23.6	23.6	220	220	8.2	5.8	5.3
	PPS-GF40%	1.6	8	12	-	-	-	-	-	-	-
Round Rod	DIALEAD Composite (high elasticity)	1.8	400	350	-	-	-	-	-	-	-
	DIALEAD Composite (high strength)	1.6	115	115	-	-	-	-	-	-	-

1.DIALEAD Composite values are calculated from epoxy resin.
2.*2CFRP: Carbon fiber reinforced plastics
3.*3Square and round pipe can also be manufactured using DIALEAD Composite.
•*These values represent typical values and calculated values. Actual values may vary.

Robot hand for liquid crystal glass

A courtesy of YASKAWA Corp.

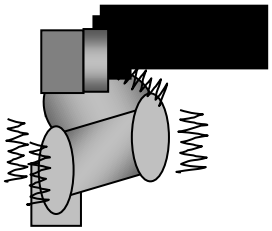
In addition to lightweight and high stiffness, the excellent vibration damping property realizes the improvement of productivity in the field of mechatronics.

G8 case study

Material		Target	Steel	Al	PAN-RM CFRP	Pitch-HM CFRP
Modulus	[GPa]	-	206	69	100	320
Weight	[kg]	<100	370	125	75	80
Self deflection	[mm]	(8)	58	59	24	8
Load Deflection	[mm]	8	10	28	20	6

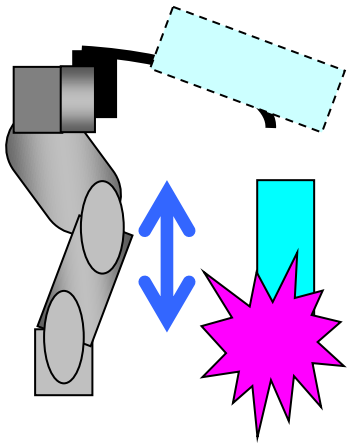
Steel:

× Motor power over



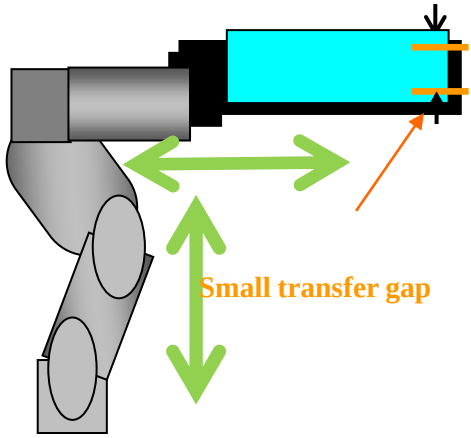
PAN-RM CFRP:

× Deflection
× Unstable transfer
× Big transfer gap



Pitch-HM CFRP:

○ Light weight
○ Stable transfer
○ Saving space



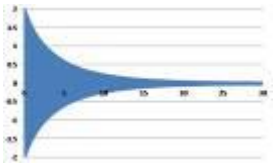
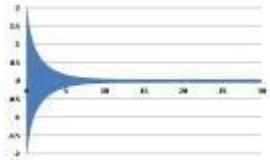
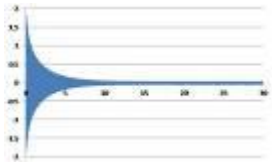
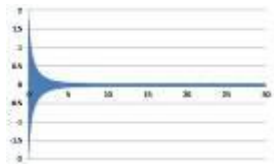
Beams for transfer machines

High stiffness and weight reduction achieve vibration damping in a short period of time, improving tact time and productivity.

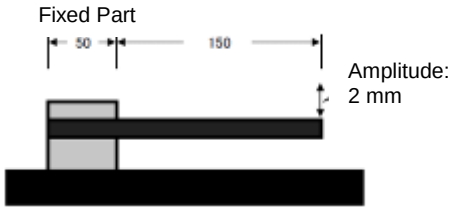
"Courtesy of Daimler Chrysler Aerospace, Dornier GmbH and Muller Weingarten AG"

Comparison

Vibration Damping Properties

	Steel	Aluminum	STD-PAN CFRP	Pitch CFRP
E (GPa)	197	72	130	352
ρ (g/cm^3)	8.0	2.7	1.5	1.7
Waveform				
F. (Hz)	32	36	60	106

Specimen: 200L x 15W x 1t (mm)

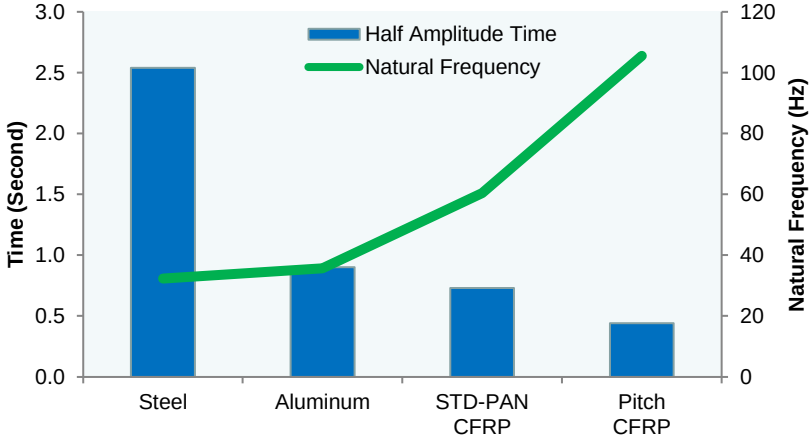


F: Calculation formula of Natural Frequency

$$F = \frac{0.178\,\pi}{L^2}\sqrt{\frac{E\,I}{\rho\,A}}$$

E: Young's Modulus
I: Moment of Inertia
P: Density
A: Cross Section Area
L: Beam Length

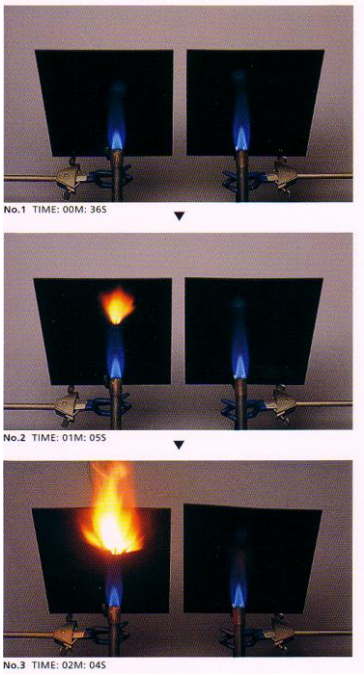
Pitch based CFRP
Natural Frequency: 3 times of Steel Vibration
Damping: 1/5 of steel



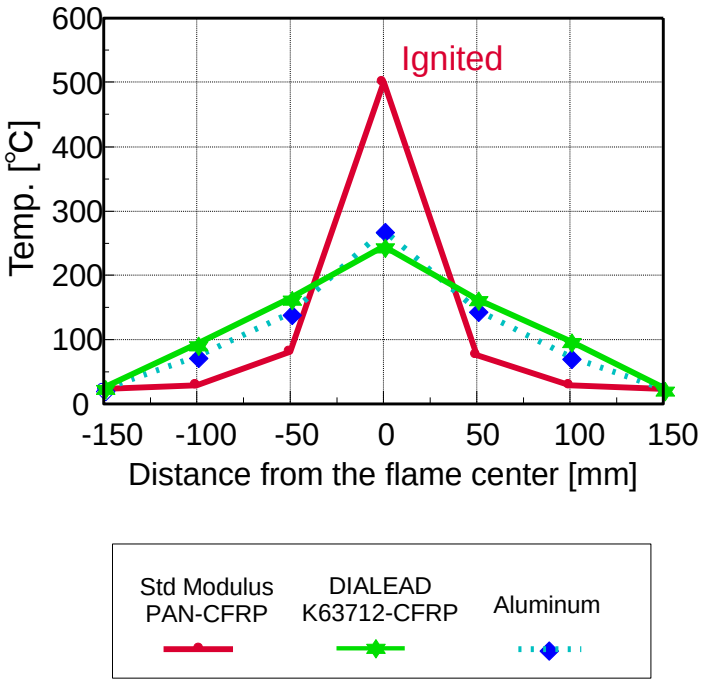
Non-Flammable Material

Std. Modulus PAN-CFRP

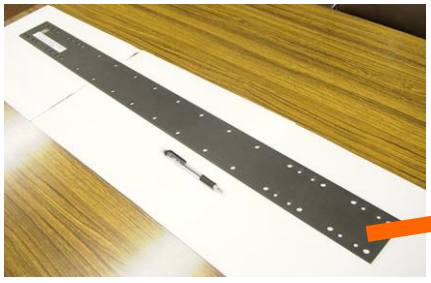
DIALEAD® K63712 CFRP

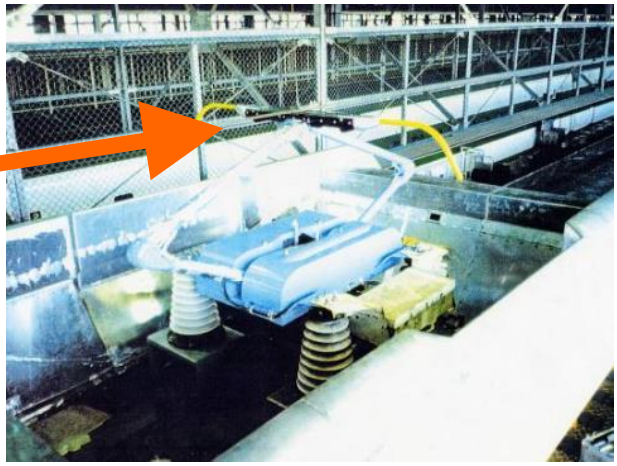


Certified as a nonflammable material by Japan Railways.
(JRS 17400-5A-15BR3A)



Base plate for pantographs on train





Light weight：

- Minimize bounding achieves excellent contact to overhead wire
- Double → Single arm

Nonflammable：

- No “spark” problem

Order Flow of Dialead Composite

DIALEAD Composite can be tailored to your applications and specifications.

Dicussion Design & Specification	Estimate	Orders	Delivery
Functional properties FEM method Chemical properties Heat resistance Chemical resistance Weather resistance Processing details Screws, Securement methods Foam Optimazation	Quantity/Schedule Form/Jigs Packaging specifications	Production Design Mold Preparation Forming process Processing and Assenbly Surface Treatment process Inspection and Shipping	Lead Time : 3 to 12 weeks Depending on products

Design Support

- We meet customer needs by optimal design and material selection of composite.

Prototyping / mass production

- We are a unique manufacturer that has a complete production system from carbon fiber to carbon fiber composite products
- We can offer quotations from prototyping to mass-produced items.

Prices / quality

- Thanks to ISO-based quality control and production structures, we offer quality, competitive composite products.