

CARBOLEADER™

High Performance Carbon Fiber Composite Roller



MITSUBISHI CHEMICAL CORPORATION

"CARBOLEADER™", Delivering high performance!!

Mitsubishi Chemical Corporation is a primary manufacturer of PAN and the world's largest manufacturer of pitch-based carbon fibers, providing the raw materials of choice for carbon fiber composite rollers. CARBOLEADER™ high performance carbon fiber composite rollers were developed as a result of incorporating DIALEAD™ carbon fiber and roller-processing technology developed in cooperation with Sunray Co.Ltd.

CARBOLEADER™ rollers are used in the wide array of industrial applications such as film manufacturing, Liquid crystal display(LCD) manufacturing, battery manufacturing, printing, etc... The advantages of low inertia, low deflection and high natural frequency(critical speed) allow CARBOLEADER™ to exceed demands in many applications.

CARBOLEADER™ allows customers to achieve key attributes such as higher quality, improved productivity, overall cost reductions and energy efficiency. (Mitsubishi Chemical has recently been established from the merger of Mitsubishi Chemical, Mitsubishi Plastics and Mitsubishi Rayon in April 2017)

CARBOLEADER™ received two awards from the Ministry of Economy, Trade and Industry (METI) in 2015

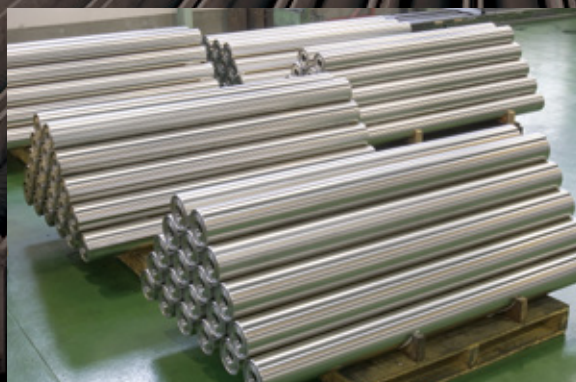
- ① **The Sixth Monodzukuri Nippon Grand Award "The Excellence Award" (Manufacturing Japan Grand Prix)**
The Monodzukuri Nippon Grand Award is a program to recognize outstanding individuals engaged in monodzukuri (manufacturing)..
- ② **The 4th Sokeizai Industry Technology Award "METI Manufacturing Industries Bureau Award"**
The Sokeizai Award is a program to recognize limited number of companies who manufacture high technology products.



DIALEAD™

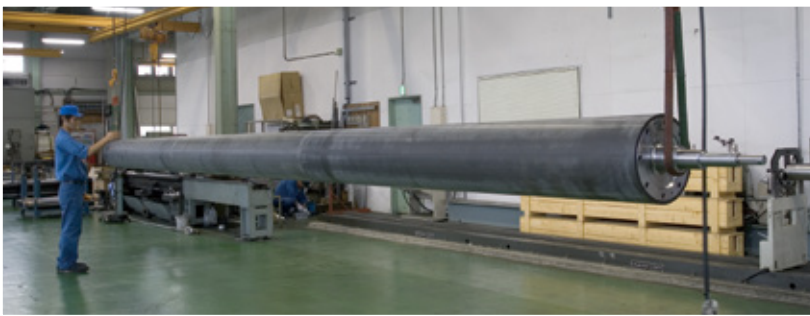
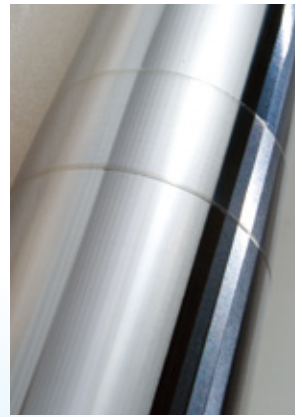
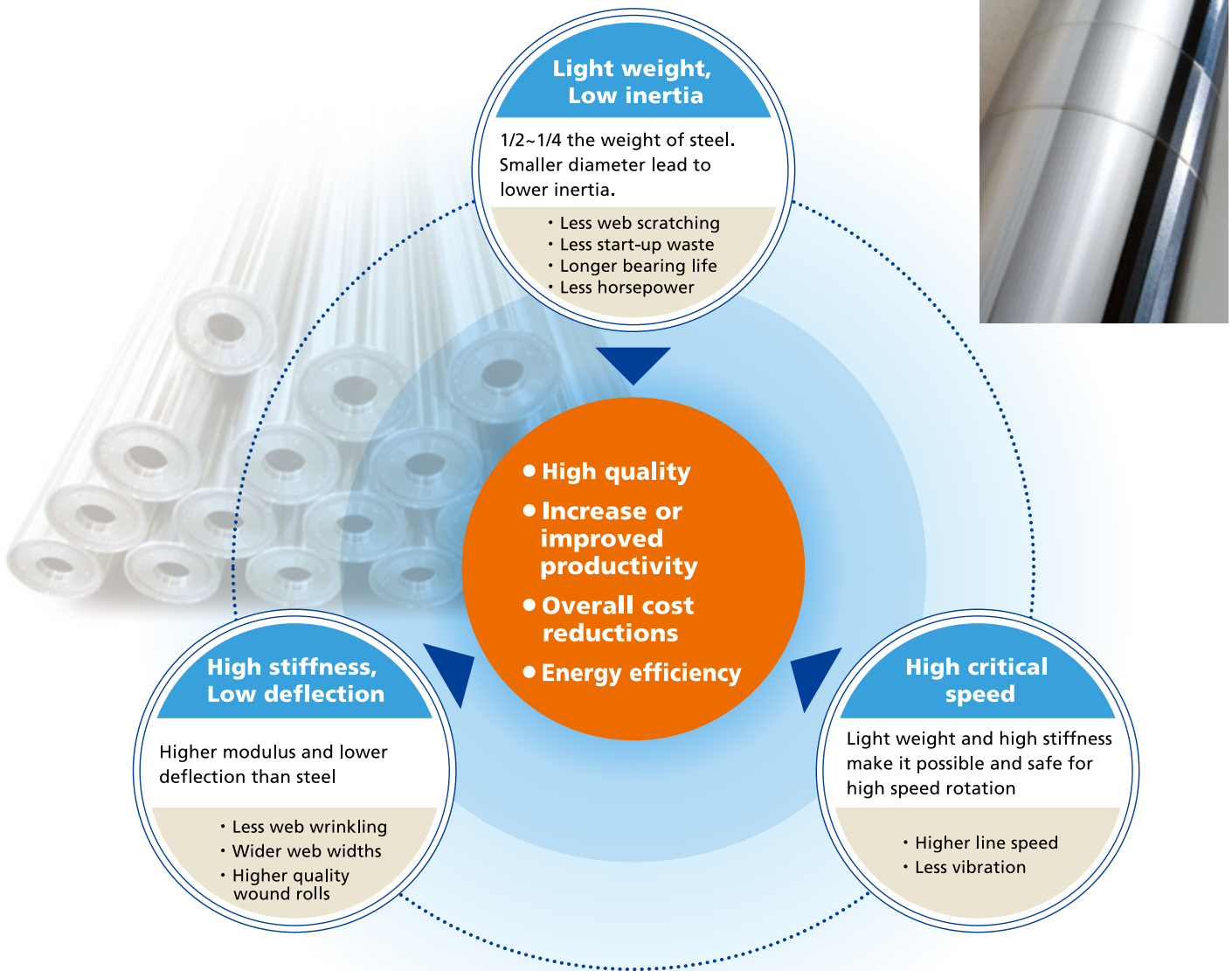


Partnership company (roller assembling): Sunray Co, Ltd.



Advantages of CARBOLEADER™ rollers

CARBOLEADER™ allows for higher machine performance.



Design example of CARBOLEADER™ roller

Need lower deflection for high performance machine.

Basic equation of deflection Deflection increases with the 4th power of length.

$$y_{\max} = \frac{5}{384} \cdot \frac{W \cdot L^4}{E \cdot I}$$

To reduce the deflection

- Weight : Lighter (Lower density, Lower load)
- Modulus : Higher
- I = Area moment of inertia [mm⁴]

Typical properties of materials

	Steel	Aluminum	CARBOLEADER™ 160	CARBOLEADER™ 240
Density [g/cm ³]	7.9	2.7	1.6	1.7
Modulus [GPa]	206	69	160	240
Deflection-ratio	5.4	5.5	1.4	1

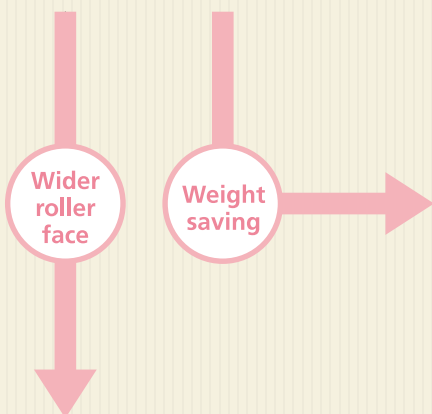
※ "Deflection-ratio" is the ratio of each dead load deflections. (CARBOLEADER™ 240 is baseline, equal to 1)

Design example

Existing roller

Tension = 20kg/m, Design speed = 1/2 critical speed X 0.8

Material	OD [mm]	ID [mm]	Face [mm]	Weight [kg]	Deflection [mm]	Moment of Inertia [kg·m ²]	Design speed [m/min]
Steel	140	130	2,000	43	0.08	0.72	1,010



Need lower weight, but same size

Material	Weight	Deflection	Moment of Inertia	Design speed
Aluminum	21	0.16	0.32	1,000
CARBOLEADER™ 160	16.5	0.08	0.23	1,950
CARBOLEADER™ 240	17	0.06	0.24	2,330

Need wider span, and same deflection

Material	OD	ID	Face	Weight	Deflection	Moment of Inertia	Design speed
Steel	180	160	2,500	118	0.08	3.25	1,060
Aluminum	220	200	2,500	65	0.08	2.48	1,560
CARBOLEADER™ 160	160	140	2,500	30	0.08	0.57	1,590
CARBOLEADER™ 240	140	120	2,500	26	0.08	0.37	1,440

CARBOLEADER™ advantageous for various applications

From precise performance to general purpose

▶▶▶ General purpose

Providing the same surface treatment options as existing metal rollers

● Chrome plating

Unique technology, "Cladding", achieves good durability and long life surface.

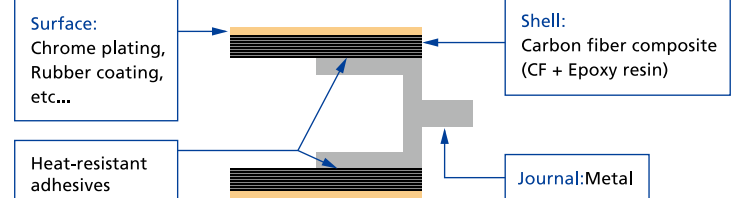
● Rubber coating

The original high performance resin system assures numerous resurfacing cycles for rubber coating.

● Ceramics thermal spraying

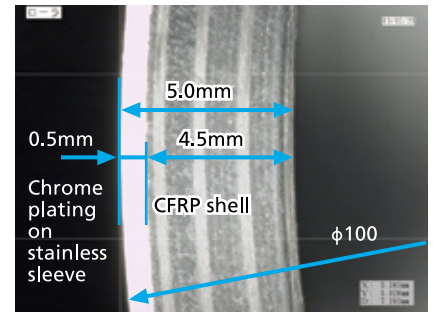
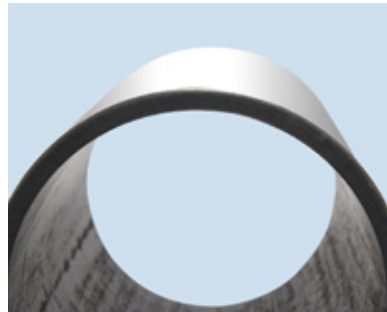
This system has a lot of experience for paper making machines.

Basic structure of carbon fiber composite roller



● What is "Cladding" technology?

This technology can make metal surface CFRP rollers by installed CFRP tubes into metal sleeves. It can durable metal surface on carbon roller with low cost and high productivity.



Cross section of "cladding" CFRP roller

▶▶▶ High precision

CARBOLEADER™ achieves high performance by our original design and balancing system.

We offer innovations for even most critically designed "small diameter x long length x high speed rotation", rollers.



Finishing process



Measure Run-out by laser



Dynamic balance at 2002rpm



Dynamic run-out at 2002rpm

Representative applications of CARBOLEADER™

Production maximum size

Rubber coating surface ,Ceramics thermal spraying surface — OD 600[mm]×FL10[m]×OL12[m]
Chrome plating surface — OD 350[mm]×FL10[m]×OL12[m]

Heat resistance specification roller

We have actual results used in 150°C atmospher

● Coating roller



● Roller for film production line (face length 5m, clad roller)

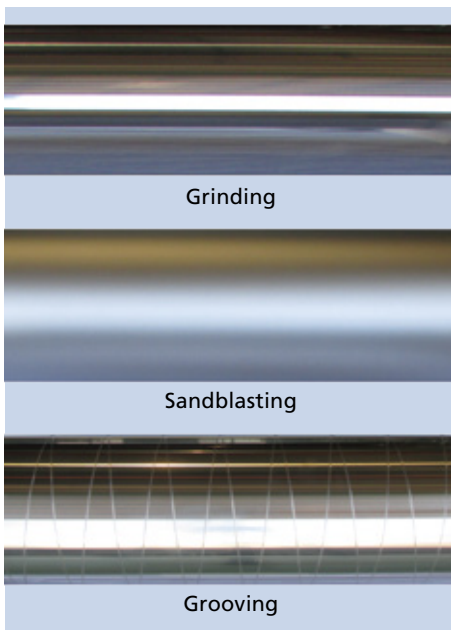


● Roller for film production line (face length 9.2m, clad roller)

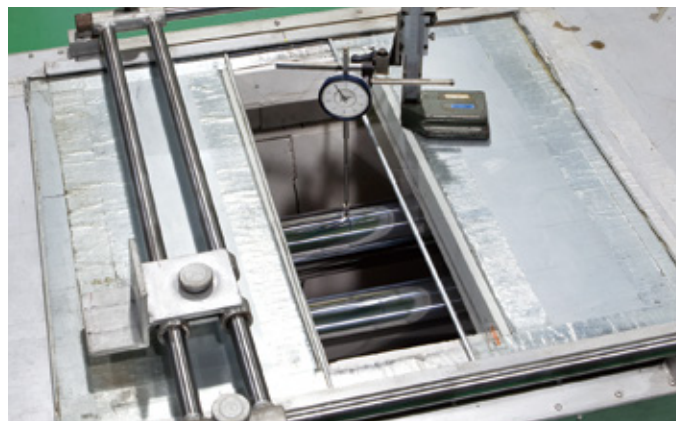


In 2018, listed "The Essential Historical Materials for Science and Technology" by the National Museum of Nature and Science.

● Roller for film production line (Chrome plating surface)



● Heat resistance specification roller

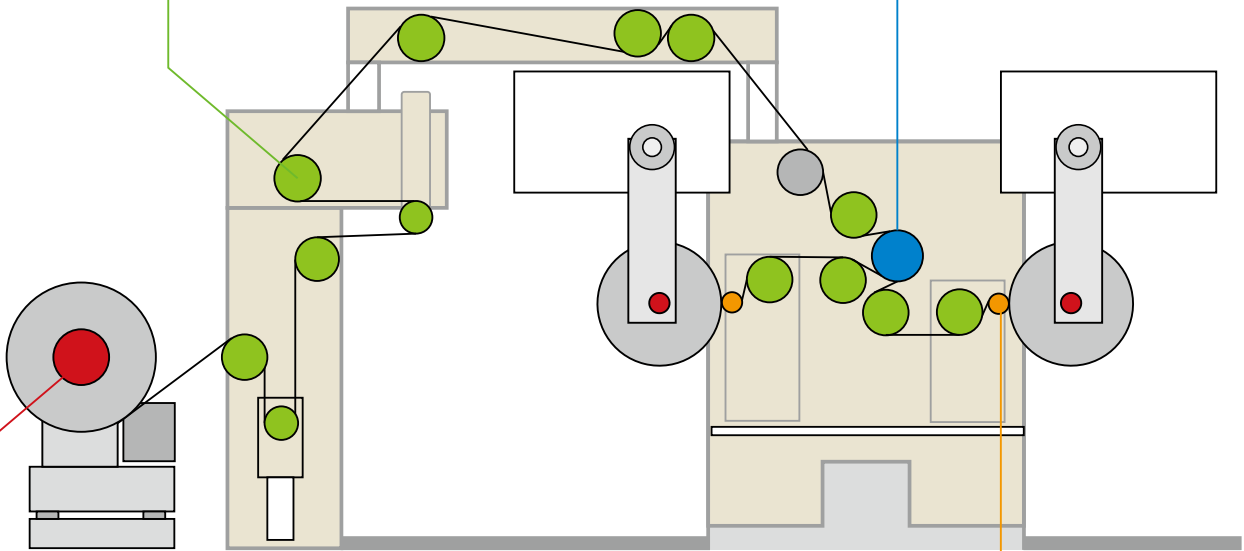
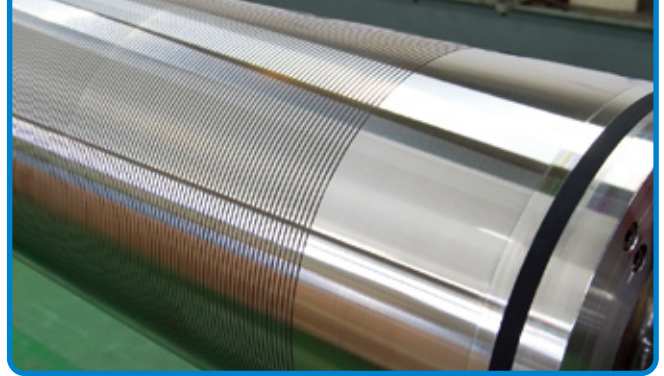


CARBOLEADER™ for film splitter

Rubber lining rollers



Grooved roller



● Rubber lining rollers ● Winding core ● Grooved roller ● Low deflection system contact roller

Winding core



Low deflection system contact roller





CARBOLEADER™
High Performance Carbon Fiber Composite Resin



MITSUBISHI CHEMICAL CORPORATION

<https://www.m-chemical.co.jp/carbon-fiber/en/>



1-1, Marunouchi 1-Chome, Chiyoda-ku, Tokyo 100-8251, Japan TEL: +81-3-6748-7359 FAX: +81-3-3286-1341

Designated factory **Sunray, Co. Ltd.** 342-3, Nauchi, Shiroy-city, Chiba 270-1407, Japan TEL: +81-47-491-3041 FAX: +81-47-491-3040

Contact

Japan and Asia **Mitsubishi Chemical Corporation (The above)**

America **Mitsubishi Chemical Carbon Fiber and Composites Inc.**
5900 88th St Sacramento, CA 95828 TEL: +1 (800) 365-5533 Website: www.mccfc.com

- The information and data contained in this brochure are as of July, 2022.
- The content of this brochure may be changed without prior notice.
- CARBOLEADER, DIALEAD is trademark of Mitsubishi Chemical Corporation.
- Due to printing characteristics, the color tones may differ from the actual ones.
- The transcription of any data or information contained in this brochure without prior written consent is strictly prohibited.