

# Carbon Nanotube(CNT) yarn and CNT knitting fabric

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# Introduction

CNT is expected as a suitable material for “Low-carbon Society”, because it is lightweight, not made from petroleum feedstock, and productive energy of it is lower than that of typical carbon fiber.

## ➤ Features of our technology

We synthesized high-density CNT (MWNT) arrays for producing CNT twist yarn.

We can spin CNT twist yarn continuously from this CNT arrays.

Additionally, we succeeded in fabricating CNT knitting fabric from CNT twist yarn, because it is much more flexible than typical carbon fiber.

## ➤ Aim of this presentation

We are seeking applications using our products.

We will try to improve properties and productivity that are necessary for applications.

We hope to find users and partners who collaborate with us.



# Properties of CNT twist yarn

Property		【Development article】 CNT twist yarn( $\phi 20\mu\text{m}$ )	
Density	( $\text{g}/\text{cm}^3$ )	➡ 0.5	lighter than carbon fiber and resinous fiber
Electric resistivity	( $\Omega\text{cm}$ )	1.0E-03	equal to carbon fiber
Tensile strength	(GPa)	0.3 (1.5) <sup>※2</sup>	-
Extension percentage	(%)	15	-
Loop tenacity ratio	(%)	➡ 99	carbon fiber: under 2% typical polymeric fiber: under 80%
Knot tenacity ratio	(%)	➡ 81	
※1 Bending fatigue resistance	(times)	➡ 55,000	twice as much as copper wire( $\phi 20\mu\text{m}$ )
Acid resistance		◎	-
Alkali resistance		○	-
Heat resistance (atmosphere)	( $^{\circ}\text{C}$ )	➡ 400	-
Watt density	( $\text{W}/\text{cm}^2$ )	0.5 <sup>※3</sup>	Nichrome wire ( $\phi 20\mu\text{m}$ ): $0.9\text{W}/\text{cm}^2$

※1 【Bending condition】 Angle:  $\pm 90^{\circ}$  , Speed: 30cycle/min, Weight: 30mN, Bending radius: 1mm

※2 CNT twist yarn( $\phi 1\mu\text{m}$ )

※3 Calculated value by assuming that CNT knitting (24G,  $\square 1\mu\text{m}^2$ ) was fabricated from CNT twist yarn

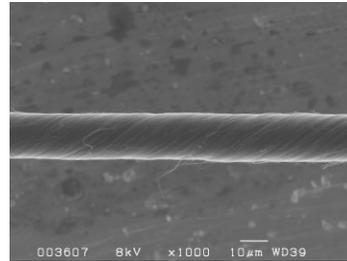
# Application of CNT twist yarn

As CNT twist yarn has high knot tenacity ratio and bending fatigue resistance, it can be used in various configurations.

They are expected as light and flexible material.

Representative configurations

- Twist yarn itself ( $\phi 1\mu\text{m} \sim$ )
- CNT sheets
- Knitting, (Netlike tube )
- Woven



As CNT twist yarn has characteristic properties (flexibility, heat resistance, chemical resistance, water repellency etc.), a variety of applications are expected.

This material can be used under hard condition because of its high chemical resistance and heat resistance

Filter

Microorganism-supporting sheet

This material has high water repellency

Gas diffusion layer

Low-fluid-resistance tube



This material can be used as heating element

Heating tube

Sheet heater

Warm cloth