

Cellulose Nano Fiber (CNF)

Cellulose nanofiber (CNF) has the size of 4-20 nm in width and several micrometer in length with large aspect ratio. Weight of cellulose nanofiber is approximately 1/5 of iron steel although possess 7-8 times strength of iron steel. Thermal expansion coefficient is as small as glass fiber whereas elasticity modulus is higher than that of glass fiber (meaning hard, strong and robust material). Cellulose nanofiber is made of plant, tree and woods based biomass therefore very recyclable and biodegradable. They can be synthesized from most kind of woods based biomass resource so that raw material is very abundant, and can be cheap.

Therefore, cellulose nanofiber is the excellent green nano materials for the next generation future and research and development have been going on very actively in the world.

1. Strong and light weight

Weight of cellulose nanofiber is approximately 1/5 of iron steel although possess more than 5 times strength of iron steel which is even close to the physical property of carbon nanofiber.

Therefore, cellulose nanofiber is mixed with resin, thermoplastic etc... and can be applied to parts of automotive, airplane and architecture which would results in much of weight and energy saving.

2. Transparent

Cellulose nanofiber is basically chemically and physically untangled plant fiber. So that one of the fibers has the diameter only in 4 – 20 nm Cellulose nanofiber can be mixed into transparent resin such as acryl, epoxy resin to be reinforced while maintaining its transparency since the size of cellulose nanofiber is much smaller than visible light wavelength range (400-800 nm)

3. Low Thermal Expansion Coefficient

Cellulose nanofiber will not expand even under high temperature so that can be used to increase the viscosity of such products as cosmetics, also can be replacement of glass.

4. Huge quantity of material resource

Cellulose nanofiber is made from woods, trees, plant based biomass materials so that material resource is huge, and can be economically cheap in the end.

5. Economically friendly and cheap.

Because of huge material resource, price can be cheap after all.

6. Recyclable and biodegradable

Because cellulose nanofiber is made from all natural resources, they are very recyclable and biodegradable, very environmentally friendly.

7. Other features

High absorbing ability

High surface area

Edible

Biocompatible.

8. Application

A. Mix with plastic, resin (can be applied to parts for car, automotive, airplane, architecture etc...)

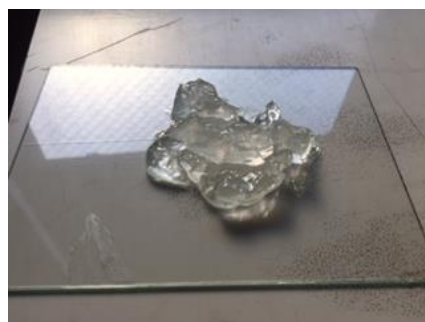
B. Strengthen various types of plastic, resin, thermoplastic while weight can be lighter

C. Filter

- D. Transparent thin conductive thin film for EL display, Solar cell**
- E. Separator for lithium ion battery**
- F. Support body for catalyst**
- G. Artificial blood vessel, ligaments (Bio medical use)**
- H. Food additive**
- I. Cosmetic products**
- J. Smoothing, reinforcing for paper**



CNF dispersion in water



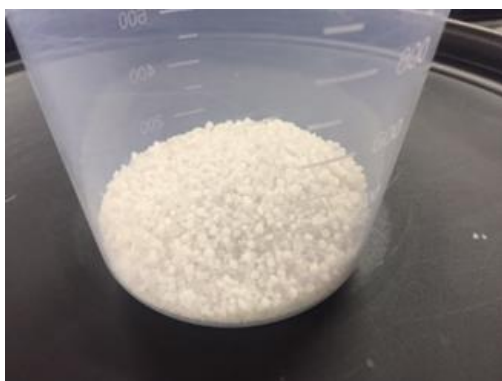
CNF dispersion in Phenyl Glycol

We can supply you in the form of cellulose nanofiber (CNF) in water dispersion. Also, we can make CNF dispersion in various type of organic solvent. Please consult with us which solvent you need such as alcohol, glycol ether based solvent, NMP, MEK, ethyl acetate etc... For example, below table indicates the basic property of CNF dispersion in water.

Moreover, we also supply CNF composite materials, mixed with polyethylene (PE), polypropylene (PP), poly vinyl chloride (PVC), acrylic resin, polyester resin etc...the concentration of CNF is 3-10 % although trying to develop to mix higher CNF concentration. Moreover, we are trying to create CNF composite masterbatch with, PS, ABS etc... on top of that, composite masterbatch or compound with biodegradable plastic such as PLA, PBS etc... Please consult with us technical detail anytime.

GS TECHNICAL INFORMATION

CNF	0.2 - 5 %
Additive and Resin	0.01 - 0.5 %
Water	95.0 - 99.0 %
Viscosity	1.0 – 300000 mPa·s/ 25 °C (can be modified depends on customer request and purpose)
CNF size (diameter)	20.0 nm – 500.0 nm



CNF mixed PE (Polyethylene) Compounds



CNF mixed Plastic test pieces

GS TECHNICAL INFORMATION

	Tensile Strength (N/mm²)
PE	10.5
PE composite mixed with CNF	14.0 - 15.0
PE composite mixed with CNF (with inorganic additive)	xxxxx
	Tensile Strength (N/mm²)
PP (random)	22.0
PP composite mixed with CNF	26.0 - 28.0
	Tensile Strength (N/mm²)
PP (Homo)	32.0
PP composite mixed with CNF	37.0 - 38.0
PP composite mixed with CNF (with inorganic additive)	xxxxx
	Tensile Strength (N/mm²)
PLA	62.0
PLA composite mixed with CNF	67.0 - 68.0
	Tensile Strength (N/mm²)
PMMA resin	43.5
PMMA resin composite mixed with CNF	54.6

Left table indicates the basic physical properties of our CNF compound.

Other resin properties such as acryl, PVC, polyester, ABS, PS etc... should be updated soon.

We will keep chasing to create plastic with higher strength. Please consult with us including technical detail anytime.