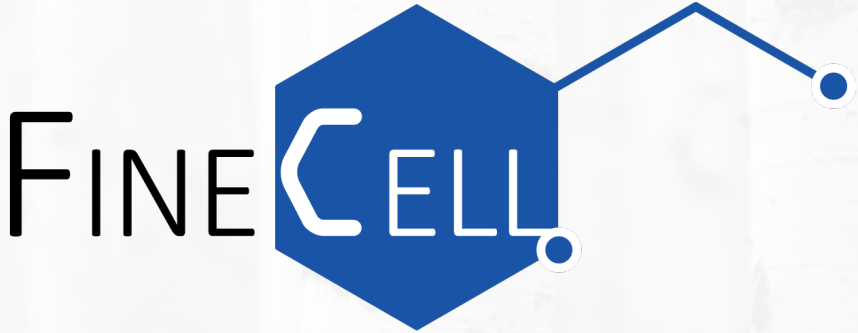
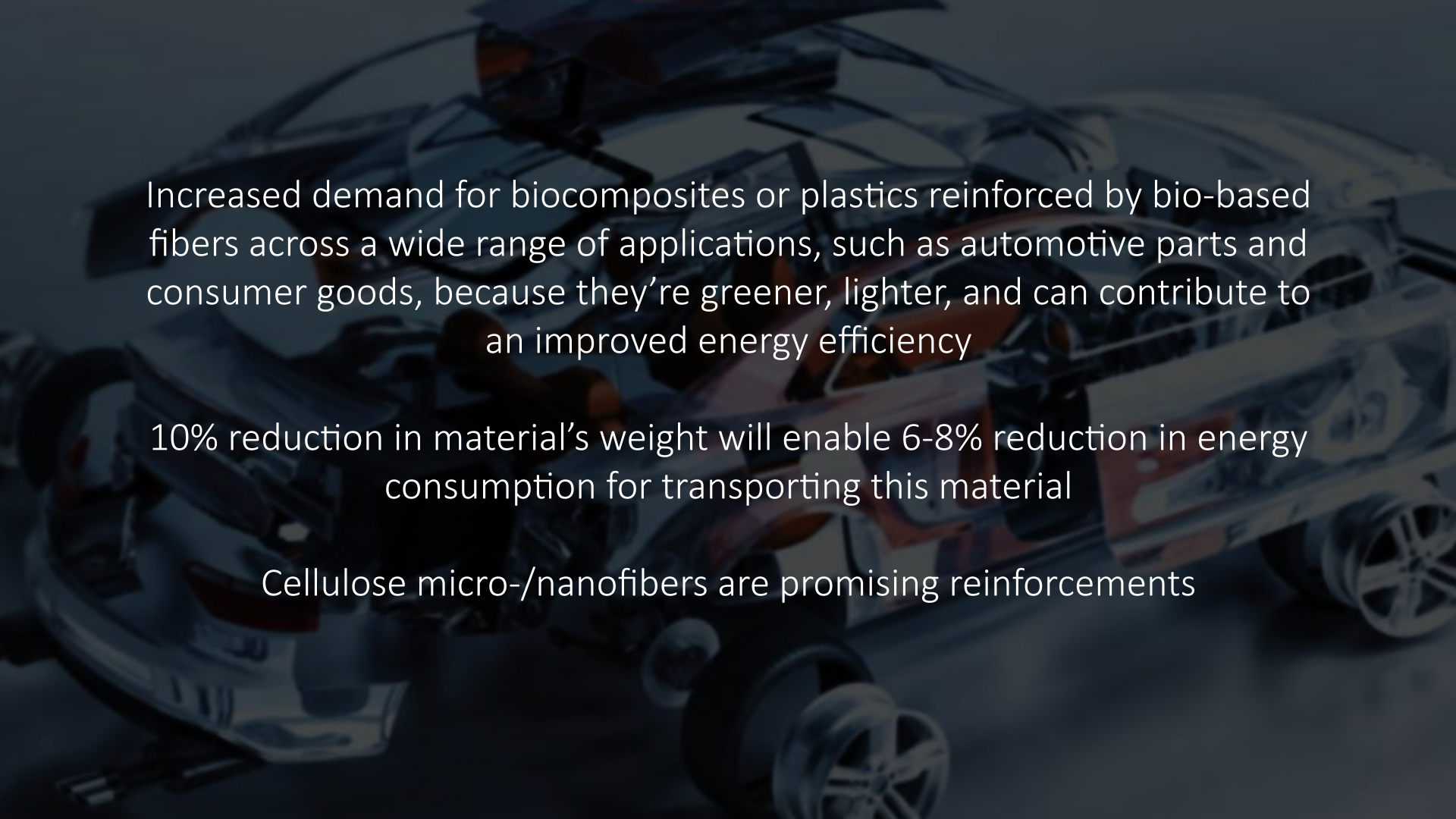


Sustainable Reinforcements for Lightweight Biocomposites

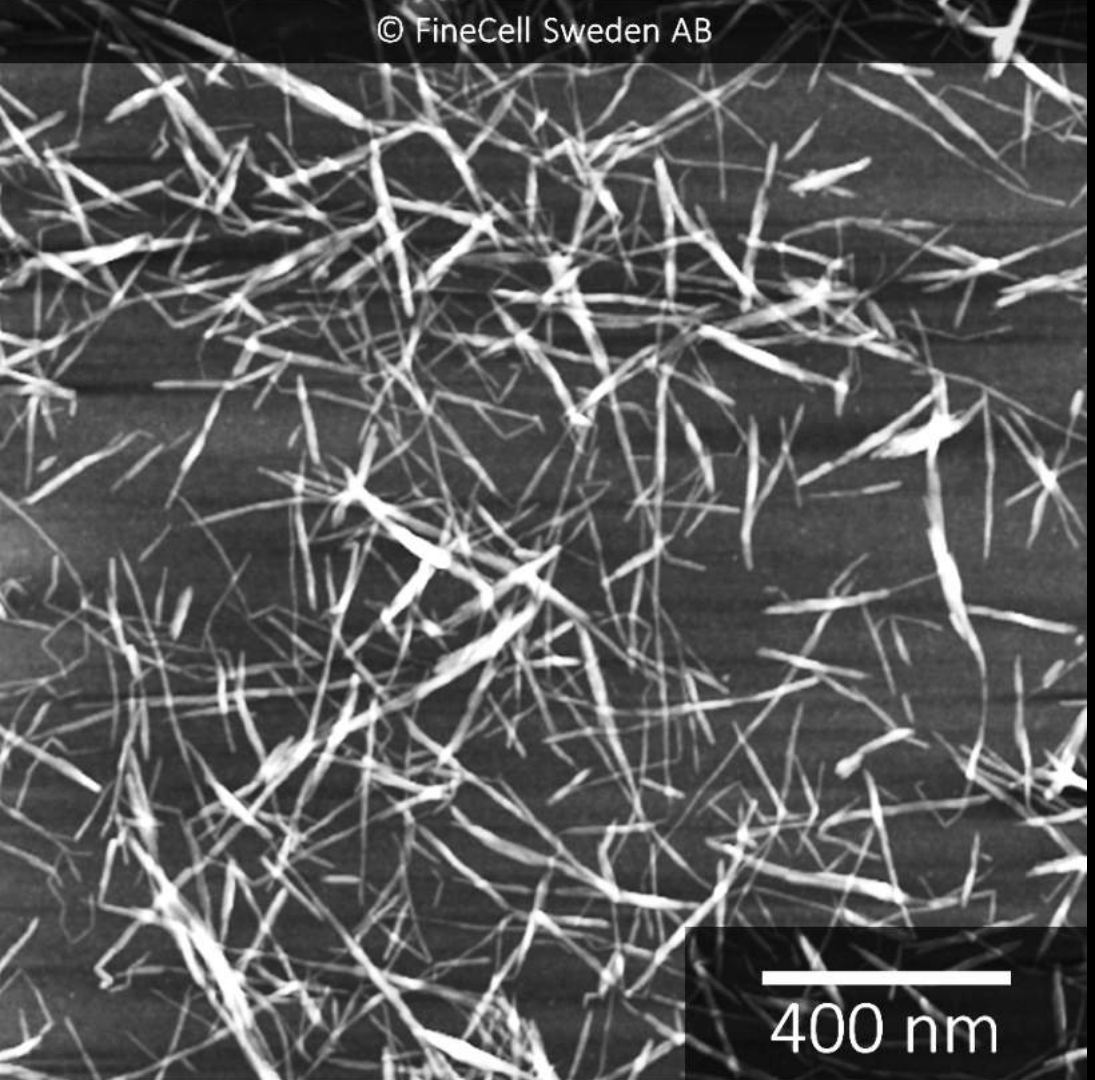
We offer cellulose micro-/nanofibers, to help manufacturers make lighter and more sustainable products without sacrificing their performances



Increased demand for biocomposites or plastics reinforced by bio-based fibers across a wide range of applications, such as automotive parts and consumer goods, because they’re greener, lighter, and can contribute to an improved energy efficiency

10% reduction in material’s weight will enable 6-8% reduction in energy consumption for transporting this material

Cellulose micro-/nanofibers are promising reinforcements

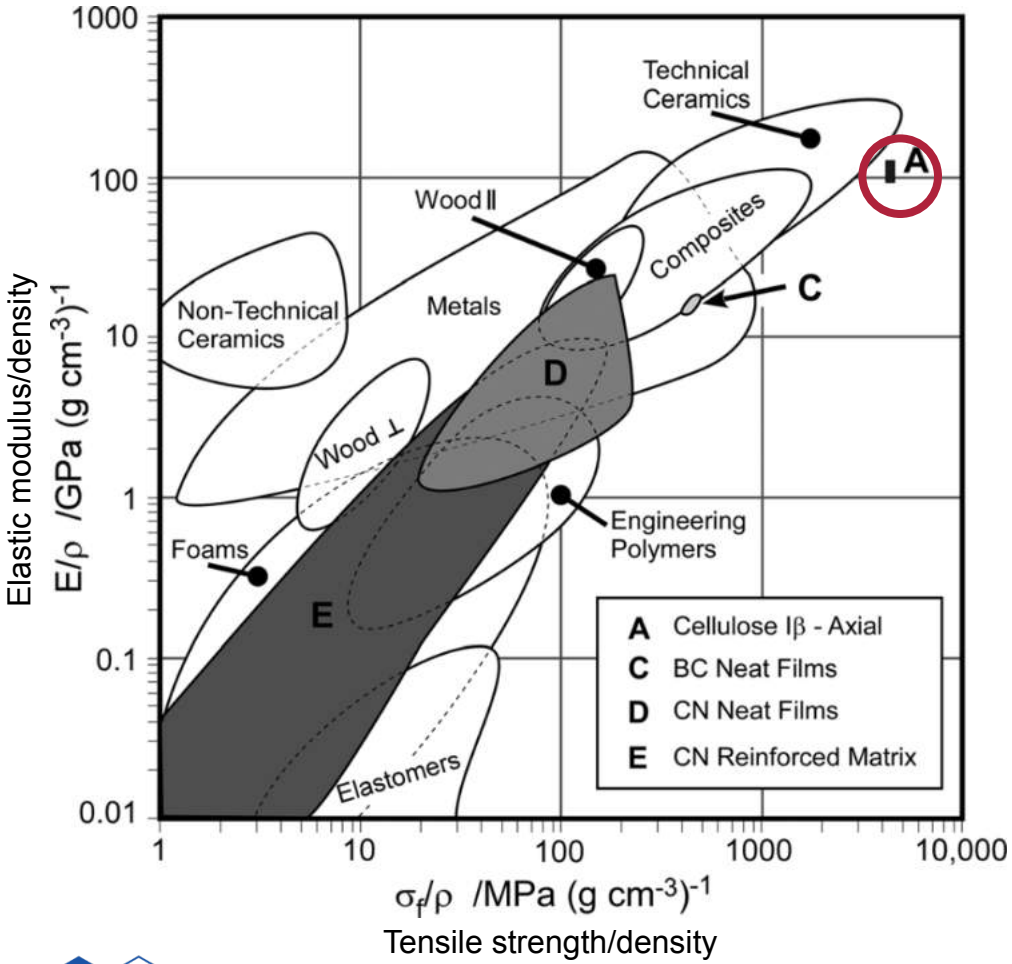


CELLULOSE MICRO/ NANOFIBERS

Tiny in size

Tremendous in strength

Grown in nature

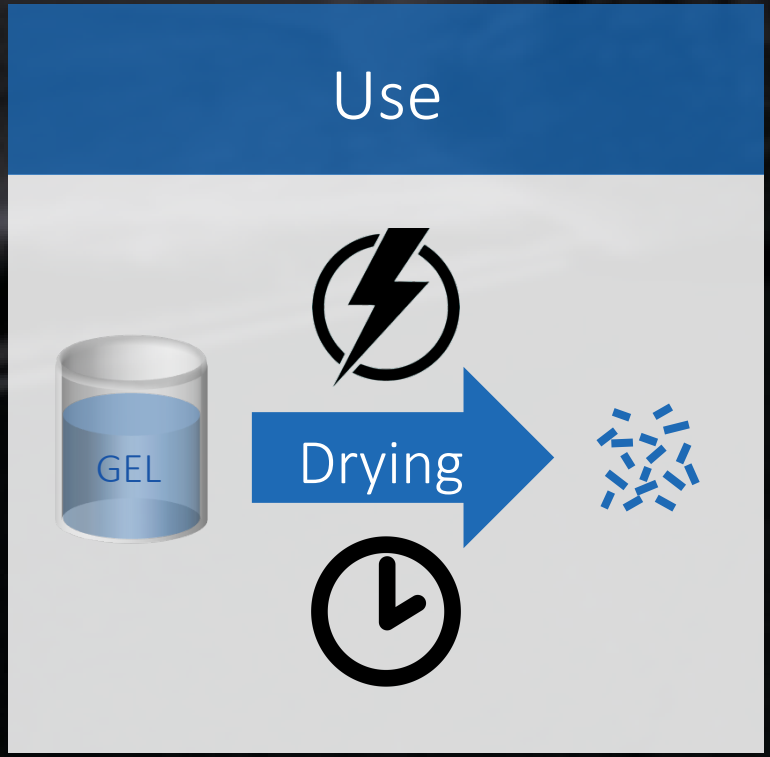


OPPORTUNITY OF CELLULOSIC REINFORCEMENTS

Crystalline cellulose (shown as "A" in the figure) ends up in the top right corner in this graph, means it shows highest specific elastic moduli as well as highest specific tensile strength among all types of materials (figure adapted from Moon et al. 2011).

CN = Cellulose micro-/nanofibers

CHALLENGES TODAY



Today, cellulose micro-/ nanofibers are mostly delivered as water-based gels, they will have to be dried before compounding with plastics, which consumes extra time and energy

CHALLENGES TODAY

Performance

Poor compatibility with molten plastic

Poor mechanical properties

Cellulose micro-/nanofibers usually have hydrophilic (high affinity to water) surfaces, whereas most plastics are hydrophobic

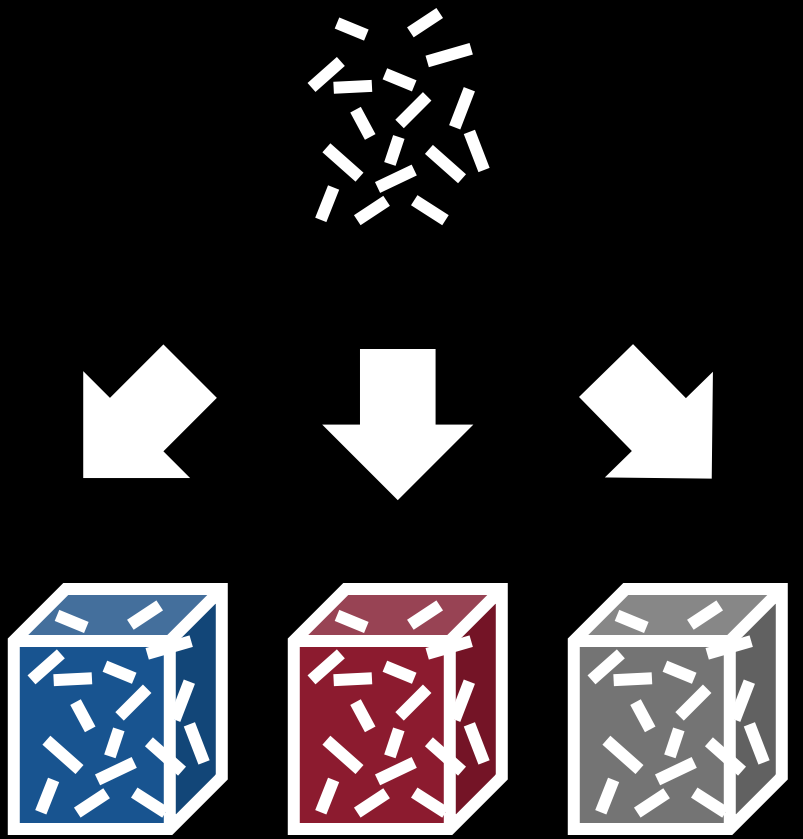
FINECELL'S SOLUTION

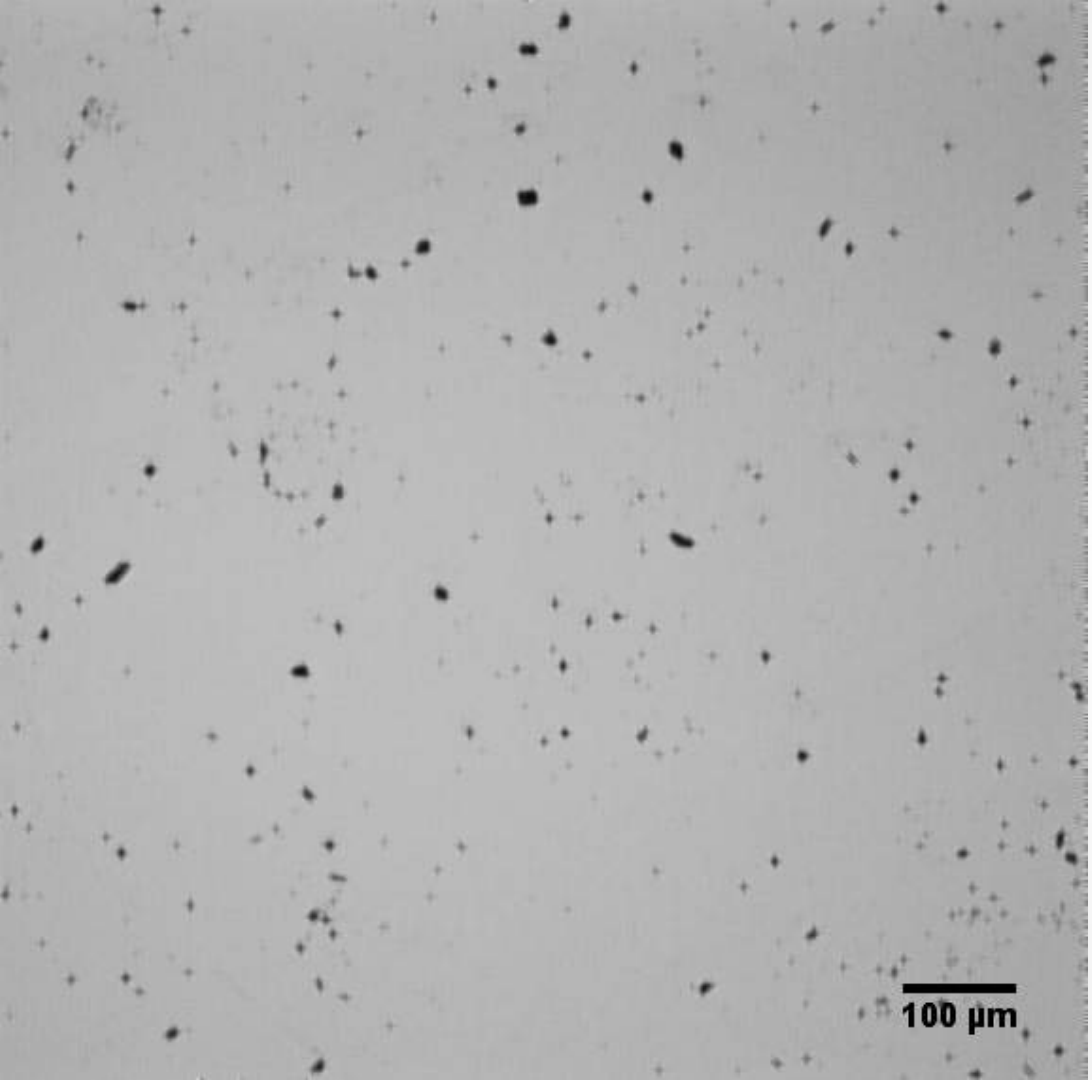
DRY Cellulose Microfiber

A dry and fine particle that suits melt-compounding processes

No need for spending time and energy on drying

Surface of FineCell’s Cellulose Microfiber can easily be made compatible with different plastic matrices





Features of our Cellulose Microfiber

Particle size

10-20 µm (seen by microscope)

Surface carboxyl content (tunable)

0.1-1.1 mmol/g

Major thermal degradation

280-375°C

WHAT MAKES OUR TECHNOLOGY & PRODUCTS DIFFERENT?

DRY PRODUCT

Easy to use for melt-compounding processes

CARBOXYL FUNCTIONALIZED SURFACE

Enabling easy modifications to become compatible with different plastic matrices

CELLULOSE MICROFIBER'S APPLICATION

SUSTAINABLE REINFORCEMENTS FOR LIGHTWEIGHT BIOCOMPOSITES

Our CELLULOSE MICROFIBER is a sustainable reinforcement and provides many benefits

1. Easy to use – dry and fine particle that suits melt-compounding processes
2. Good compatibility – can easily be made compatible with different thermoplastic formulations
3. Lightweighting – reduce material's weight (currently -45%, potentially -70%), without compromising its load-bearing performance
4. Improving sustainability – enable reduction of carbon footprint by improving sustainable factions (+10-50%) in materials

Example case

Specimen	Load of reinforcement	*Calculated density (g/cm^3)	Elastic modulus (GPa)	Change in elastic modulus	Specific elastic modulus (GPa/(g/cm^3))	Tensile strength (MPa)	Change in tensile strength	Specific tensile strength (MPa/(g/cm^3))
Neat PP	0	0.9	0.9	0%	1.0	32.2	0%	35.8
FineCell's CMF 30%	30%	1.02	1.9	+106%	1.8	37.4	+16%	36.6

*https://netcomposites.com/guide-tools/tools/calculators/volume-weight-fraction/

FORMULATION

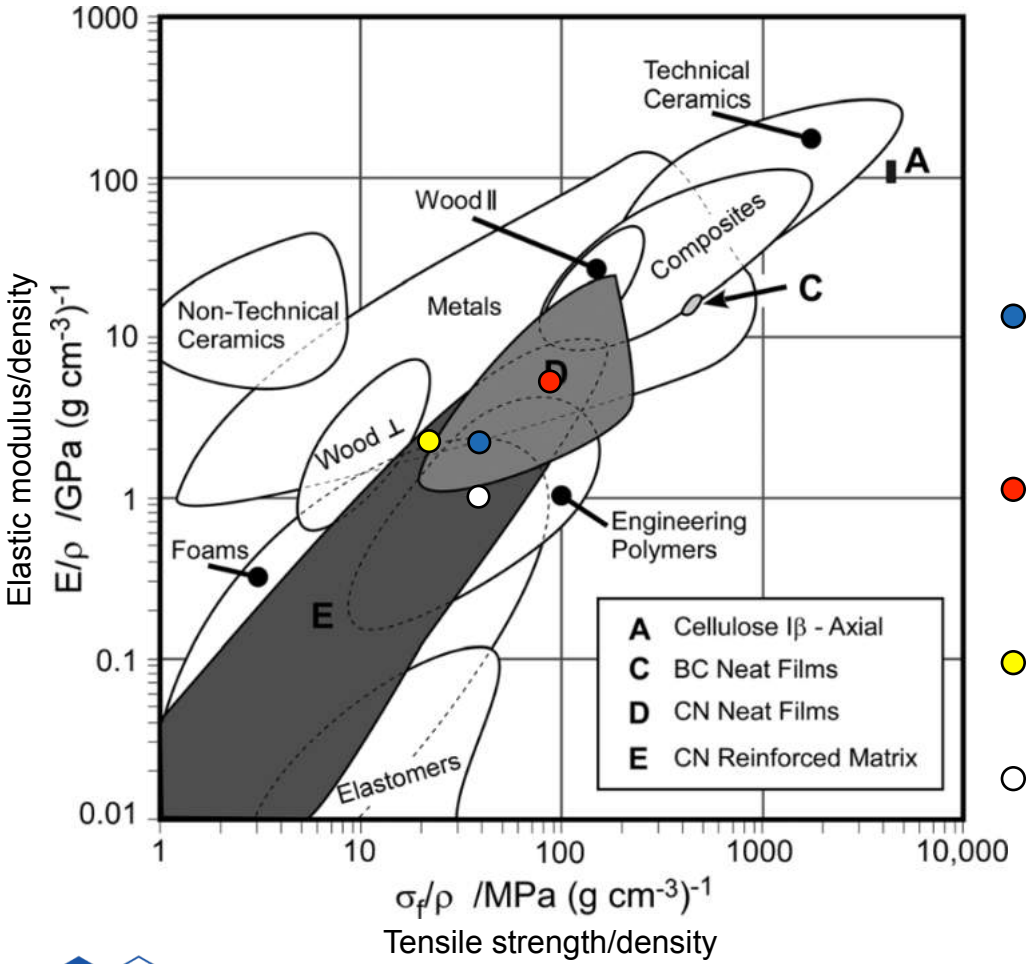
PP (pellets, MFI = 80 g/10 min)/MAPP (pellets, Mw ≈ 9100, MA content: 8-10 wt%)/FineCell's CMF = 60/10/30

COMPOUNDING

Twin-screw extrusion (190°C) followed by injection molding (190°C for injection, 40°C for molding)

TENSILE TEST

According to ISO527-2 (for specimens of types 1BA)



Comparison of composites made through melt-extrusion, PP as the matrix

- 30 wt% filler content of our cellulose microfiber, where we are today
- 30 wt% filler content, where our potential is
- 30 wt% filler content of talc (fine grade)
- Neat PP

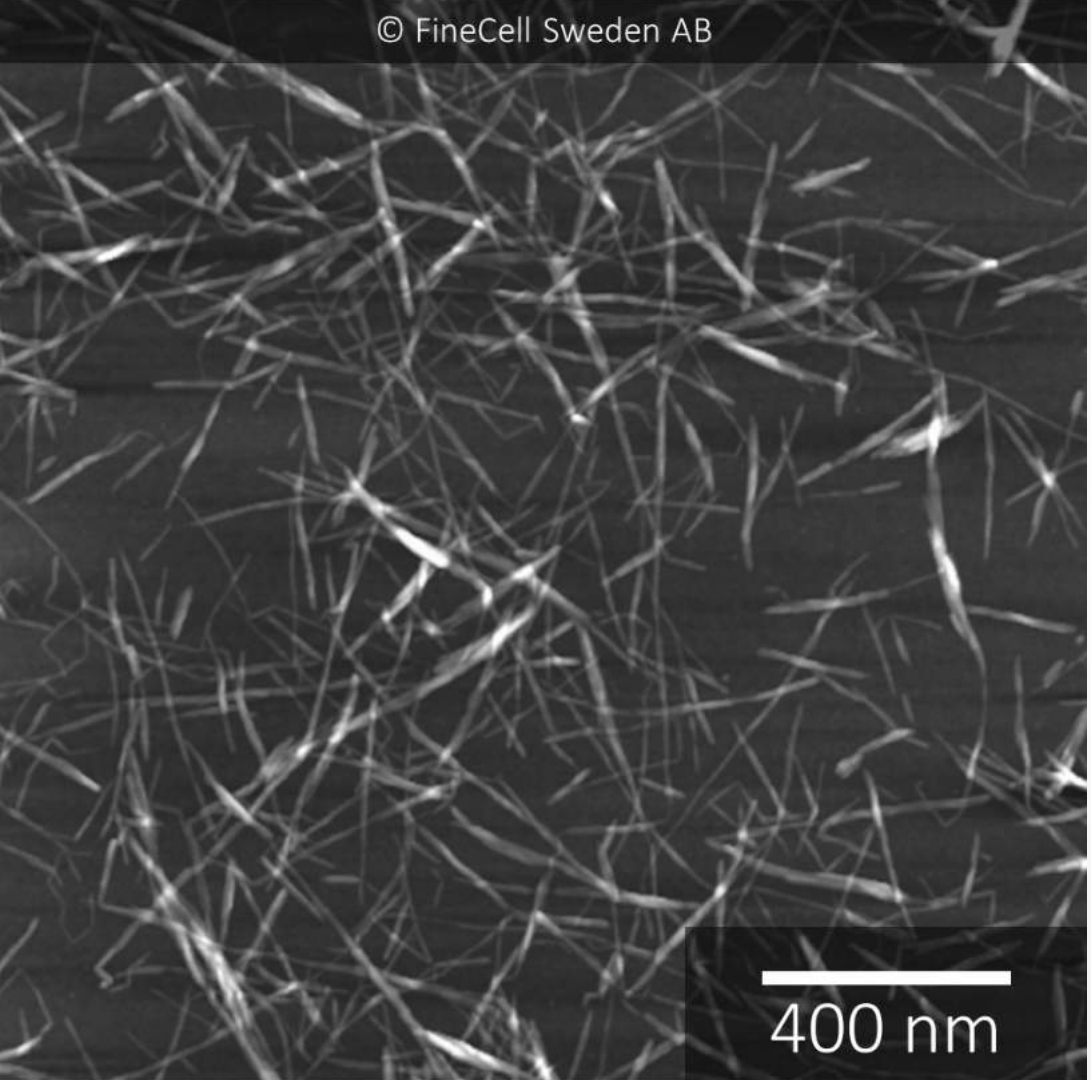
LIGHTWEIGHTING POTENTIAL

Is enabled by increasing specific modulus as a result of cellulose's reinforcement, which means less materials (in terms of weight) are needed to bear the same loads.

Reinforcement (PP as matrix)	Filler content	Lightweighting potential* (as comparing with neat PP)
1. Our cellulose powder	30 wt%	-45%
2. Talc (fine grade)	30 wt%	-31%
	40 wt%	-29%
3. Our potential	30 wt%	-70%

*Calculation model: a cylindrical material with a fixed length of 5 cm, for standing a load of 500 N. The load is applied along the length of the material.

The full potential of our cellulosic reinforcement is enabled when Cellulose Microfiber is dispersed into Cellulose Nanofiber during compounding



Cellulose Nanofiber made from Cellulose Microfiber

Dimension

Tunable length 100-900 nm

Width 3-4 nm

We are looking for compounders or plastic manufacturers to collaborate and exploit the full potential of our cellulosic reinforcements

Join us, let’s make more sustainable and lighter products!

FINECELL

Sustainable Reinforcements for Lightweight Biocomposites

Web: finecell.se | Email: info@finecell.se