

Elmarco is the industry's first supplier of industrial scale nanofiber production equipment. Our partnerships with global industrial leaders and universities form the foundation for our success.

ABOUT ELMARCO



ELMARCO
NANO FOR LIFE



ELMARCO OFFICES



Liberec, Czech Republic – Ladislav Mareš, CEO

Global headquarters, Technical Leadership Center, Corporate R&D, Sales and Equipment Production



Raleigh, NC, USA -

Ken Donahue, CEO

Sales, Service, Filtration product management

Tokyo, Japan -

Kaz Nomoto, CEO

Sales, Service, Asia-Pacific





NANOSPIDER™ ELECTROSPINNING THE ELMARCO WAY



Feature: Rotating drum, partially submerged in a polymer solution

Benefit: Mechanically simple, allows lower equipment and operating costs

Feature: Nature defines the distance between Taylor cones

Benefit: Higher fiber packing density

Benefit: Higher fiber and web uniformity

High productivity
Easy maintenance
Economical operation
Top quality of nanofibers
High-level safety
Process flexibility



BUSINESS STRATEGY - TECHNOLOGY



Upscaling of the technology

CRD



Laboratory development
- small samples

NS Lab



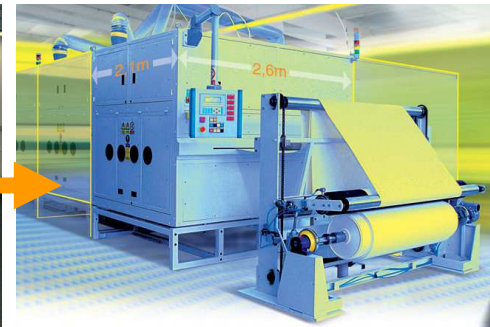
Laboratory unit
- verification in samples – 10 m² per day

NS Pilot Line



Upscale from the laboratory unit to production line
- up to 1000 m² per day

NS Production Line



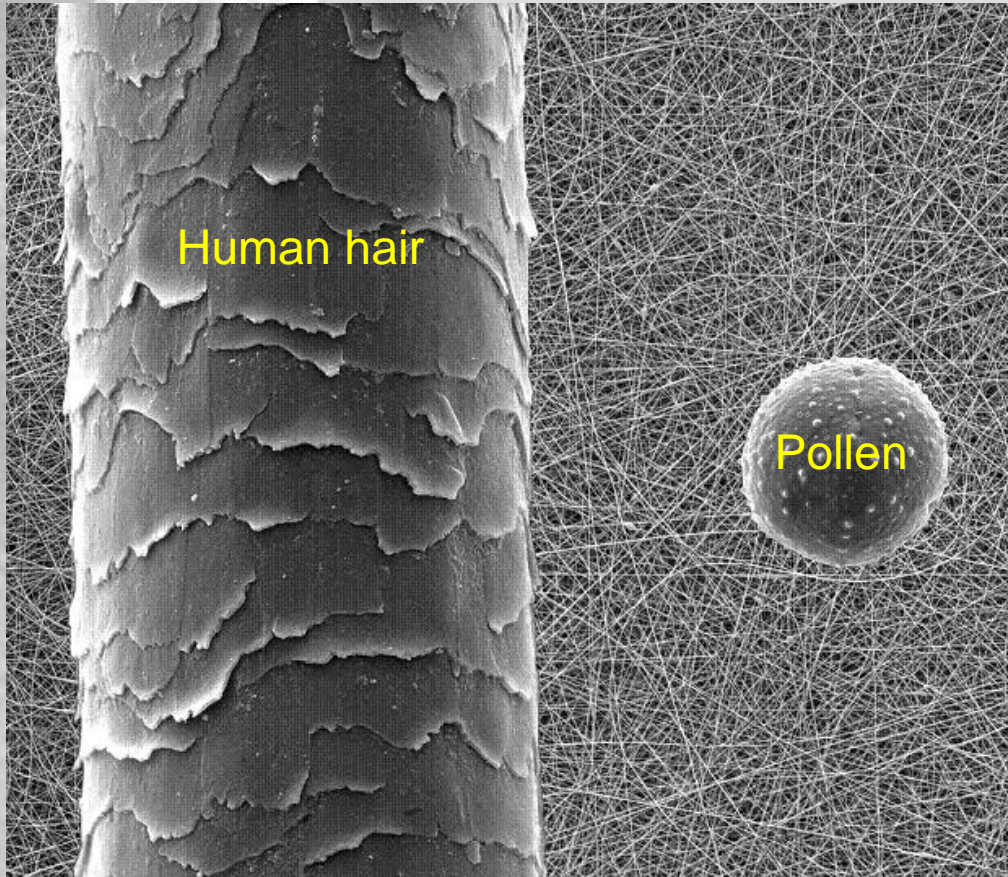
Up to thousands m² per day for NS 16



KEY FEATURES OF NANOFIBERS



**At least one dimension less than 100 nm.
Industry accepts fiber diameters below 1,000 nm.**



Human hair

Pollen

Large specific surface area

Small pore size – good breathability

Wide range of polymers capable of spinning

The possibility to incorporate different additives

High porosity

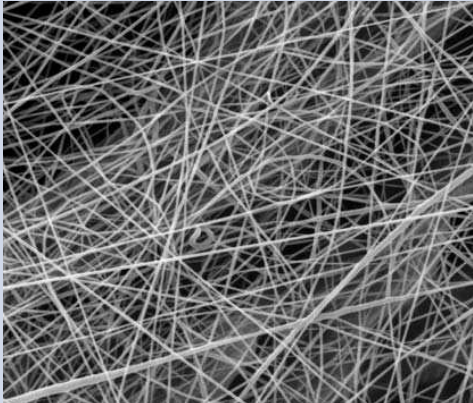
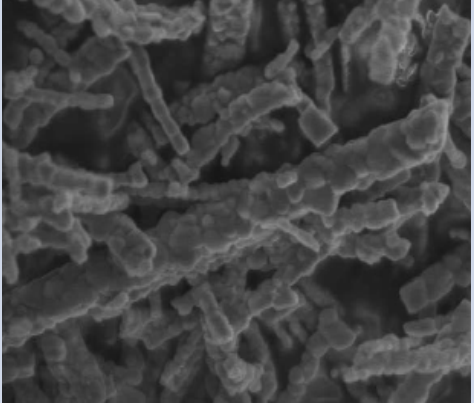
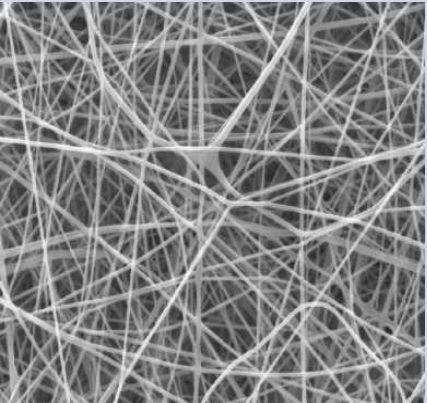
These properties bring opportunities to create new unique materials in following application fields...



NANOSPIDER™

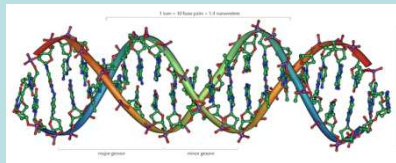
MATERIAL FLEXIBILITY



Organic	Inorganic	Biopolymers
<p>PA6, PA 6/12 Polyaramid PUR (Polyurethane) PES (Polyethersulfone) PVA (Polyvinylalcohol) PAN, PEO, PS PVP, PVP-I</p>	<p>TiO₂ SiO₂ Al₂O₃ ZnO Li₄Ti₅O₁₂ ZrO₂</p>	<p>Gelatin Chitosan Collagen Cellulose</p>
		



NANOFIBERS: APPLICATIONS



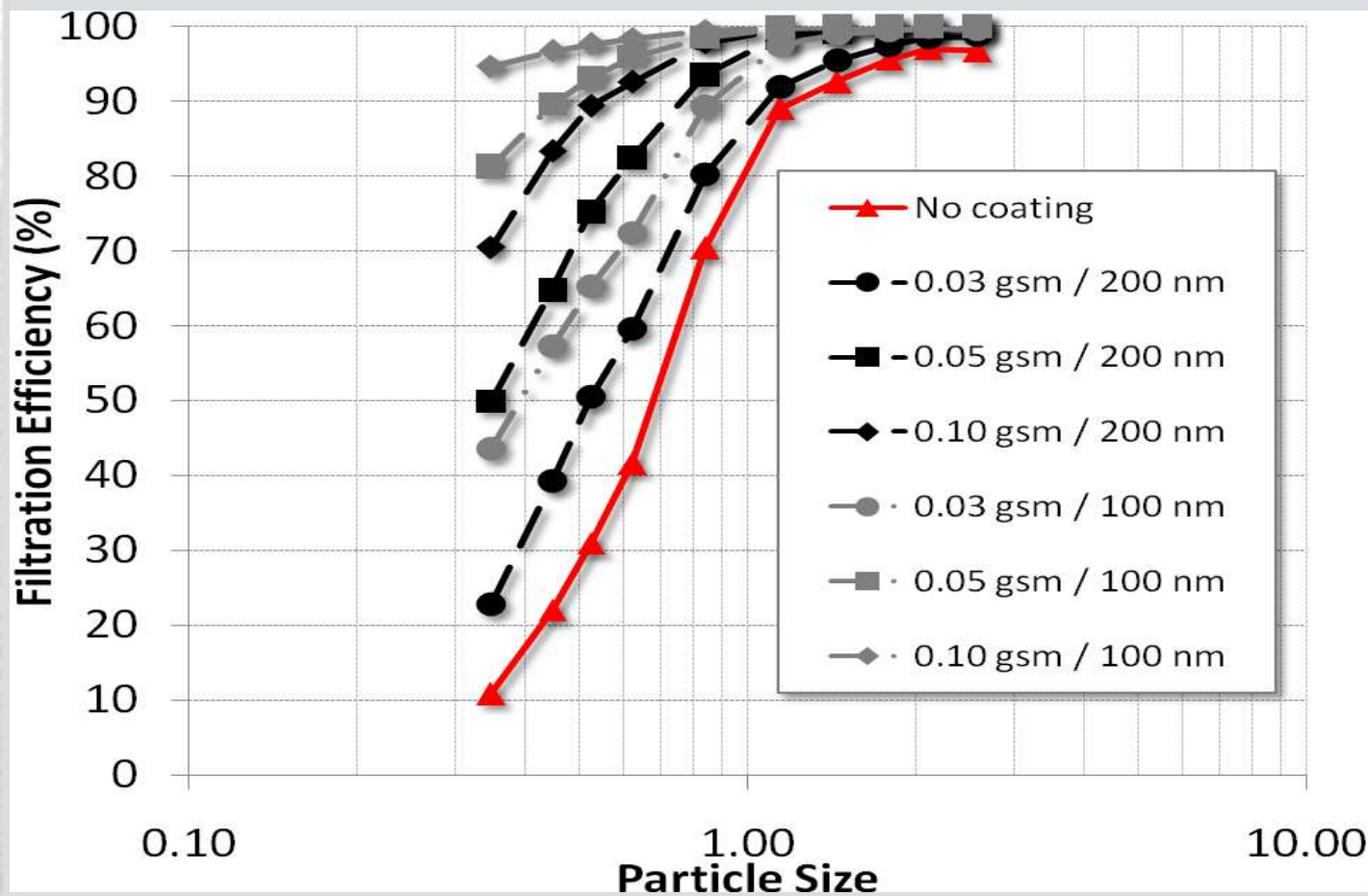
Industrial	Healthcare	Energy	Retail
Filtration Barriers Nanocomposites Sensors Acoustic insulation	Wound care Tissue scaffolds Barriers Sensors	Battery membranes Solar (DSSC)	Nonwovens Hygiene Lighting
Fiber uniformity Nanoporous Anti-microbial Novel materials Nanoporous	Nanoporous Drug delivery Anti-microbial Surface area	Uniform porosity Light transmission	Absorptive properties Thermal Light transmission



WHY USE NANOFIBERS... ...IN AIR FILTRATION



FILTRATION EFFICIENCY





WHY USE NANOFIBERS... ...AS LI-ION BATTERY SEPARATORS



CONTRIBUTION OF NANOFIBER BATTERY SEPARATORS

- Nanofiber morphology can be tuned
- Nanofiber porosity above 90 % - reduces resistance to ionic current

This enables construction of a battery with superior parameters.

Higher polymer costs of electrospun membranes are offset by:

- Lower consumption of polymer resources due to lower basis weight of the membrane
- Significant increase of battery power density
- Higher rate – faster charging
- Increase of battery life – capacity kept longer

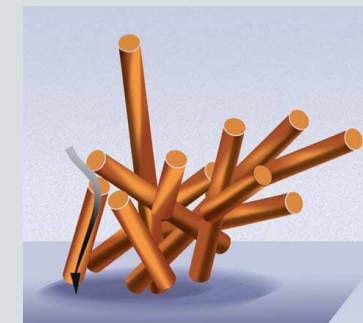
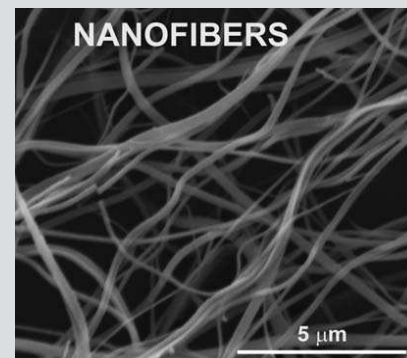
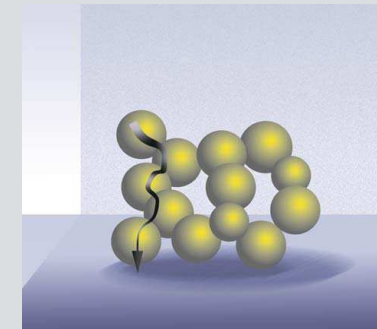
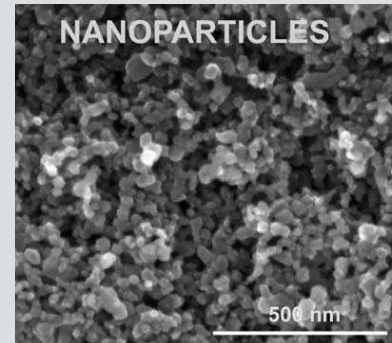


WHY USE NANOFIBERS... ...IN SOLAR CELLS



ADVANTAGES OF TiO₂ NANOFIBERS OVER TiO₂ NANOPARTICLES

- Nanofibers - almost linear path as the electron carrier - losses in the material while travelling are significantly lowered
- Nanofibers can harvest more photons (thus making more electrons) - more accessible for the light
- Nanofibers embedded in the DSSC module can make up to 25% more energy than conventional DSSC modules with nanoparticles





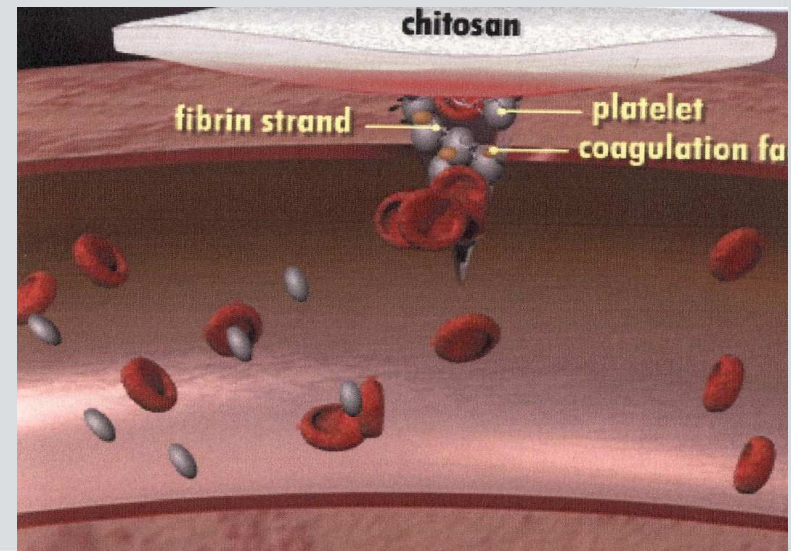
WHY USE NANOFIBERS... ...IN WOUND CARE



CONTRIBUTION OF NANOFIBERS IN ADVANCED WOUND CARE

- Permeability of gases and liquids
- High absorption capacity of liquids (exudate)
- Antibacterial and high filtration efficiency for bacteria resulting in decreased infections
- Swelling and gel forming capability to keep an area moist
- Anti adhesive effect to the derma
- Fast haemostasia

Relevant polymers produced with Nanospider™ technology include, PVA, chitosan, CMC, gelatin, hyaluronic acid, polyurethane and others.





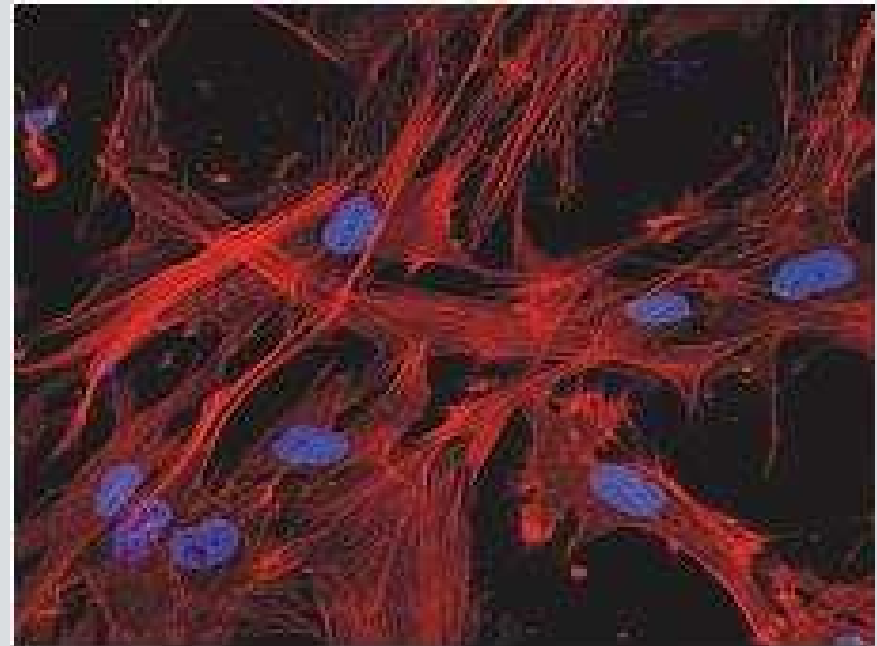
WHY USE NANOFIBERS... ...IN TISSUE ENGINEERING



CONTRIBUTION OF NANOFIBERS IN TISSUE ENGINEERING

- Good cell adhesion - supported growth and proliferation
- Proper morphology of the cell - resembling their natural shape in the tissue
- Controlled growth - stem cells are organized with respect to the orientation of the fibers

Relevant polymers produced with Nanospider™ technology include, PCL, PLA, PA6/12, gelatin and others.



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**THANK YOU FOR YOUR
ATTENTION**



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