Nanofibers, technology and applications

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What is nanofiber?
Fiber with diameter in nanometer range. Many types of polymers were processed into nanofibers of 50 to 1000 nanometers in diameter, several orders of magnitude smaller than conventional fiber spinning.

What is electrospinning?
Electrospinning is the process using electrostatic forces to form a fine filament of the polymer solution.
NANOFIBERS

Properties
- large specific surface area
- high porosity
- small pore size
- diameter range (50 – 1000) nm

Material
- Polymer solutions or melts
- More than 30 polymers, including polyethylene oxide, DNA, polyaramids, and polyaniline, have been electrospun.
- These fibers can be made of variety organic (nylon, polyester, acryl) or biological polymers (proteins, collagens).
- PVA, PS, PAN, but also peptide amphiphiles or cellulose.
In the electrospinning process a high voltage is used to create an electrically charged stream of polymer solution or melt. A high voltage electrode is linked with the polymer solution. The solution is then spun through a capillary. Due to high voltage electric field between the tip of capillary and a grounded collector, Taylor cone is formed at the tip of capillary producing sub-micron in diameter fibres. Fibres solidify as the polymer solvent evaporates and create an interlinked fiber layer on the surface of the collector.
NANOFIBRES APPLICATIONS

- Air and liquid filters
- Wound dressings
- Tissue engineering
- Surface modifications
- Sound absorptive materials
- -etc
Air filtration properties of various materials

![Graph showing efficiency vs. pressure drop for different materials: meltblown, charged meltblown, glass microfibers, needle punch, PA6 nanospider, and PA6/PU nanospider.](image)
Wound dressings

Nanofibers
Wound dressings - functions

Function of wound dressing

- Bacteria
- Air
- Drugs
- Liquids
- Wound
- Skin
Profile: Nanofibrous layer is applied by the electrospinning process to the basic fibrous material.
Basic fibrous material with the nanofibrous layers of different area densities (colored curves) vs. Basic material without the nanofibers (black curve)
Thanks for Your Attention