APPLICATION NOTE

LANXOR

Nanofibers

Nanofibers

Nanofibers are fibers with diameters in the nanometer range. They can be generated from different polymers and hence have different physical properties and application potentials. Examples of natural polymers include collagen, cellulose and polysaccharides such as chitosan and alginate. Examples of synthetic polymers include PLA, PCL, PU, PLGA) and PEVA.

The diameters of nanofibers depend on the type of polymer used and the method of production and can vary from under thirty nm up to a few hundred nm. All polymer nanofibers are unique for their large surface area-to-volume ratio, high porosity, appreciable mechanical strength, and flexibility in functionalization compared to their microfiber counterparts.

There exist many different methods to make nanofibers, including drawing, electrospinning, self-assembly, template synthesis, and thermal-induced phase separation. Electrospinning is the most commonly used method to generate nanofibers because of the straightforward setup, the ability to mass-produce continuous nanofibers from various polymers, and the capability to generate ultrathin fibers with controllable diameters, compositions, and orientations. This flexibility allows for controlling the shape and arrangement of the fibers so that different structures can be fabricated depending on intended application purposes.

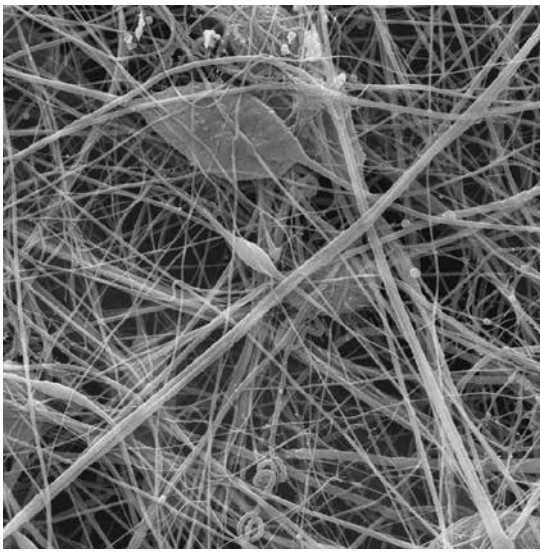
Nanofibers have many possible technological and commercial applications. They are used in tissue engineering, drug delivery, cancer diagnosis, lithium batteries, Oil-water separation, Sportswear textile, optical sensors and air filtration.

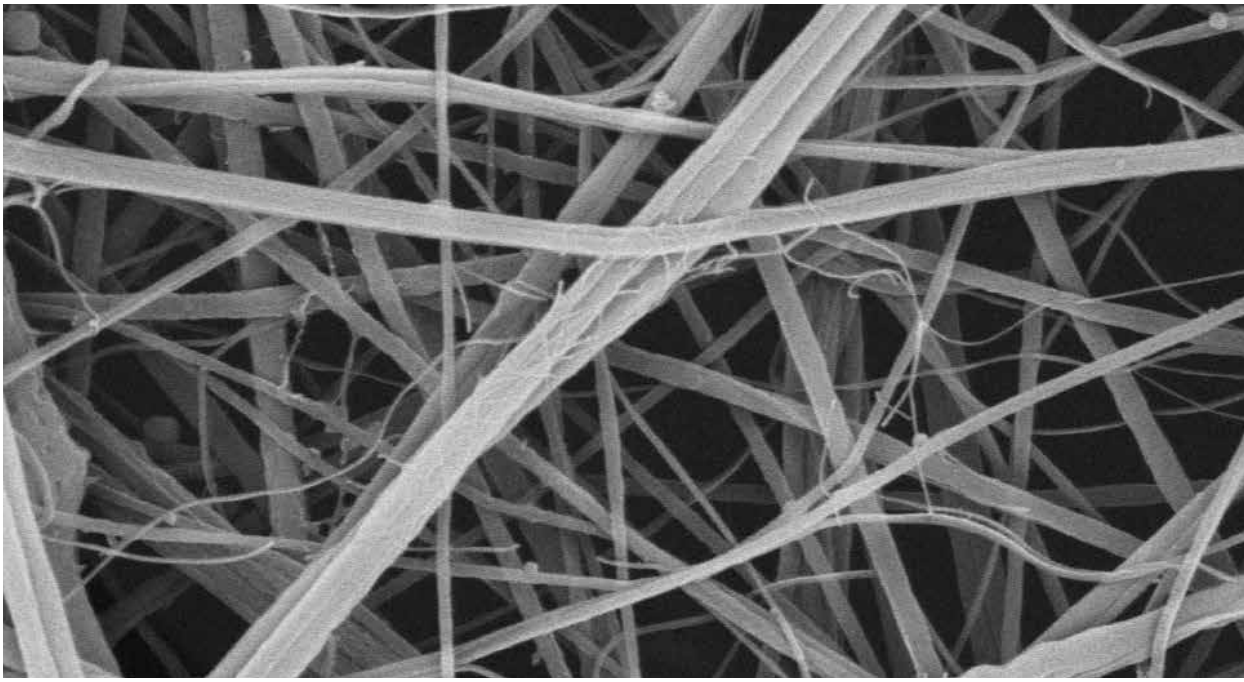
Why is SEM imaging used to study nanofibers?

SEM imaging is an ideal tool to check the homogeneity and diameter of nanofibers. SEM manufacturers have developed specific software applications for a fully automatic fiber diameter distribution measurement.

Nanofibers are also used in air filtration applications for antibacterial and nanoparticle applications. SEM imaging (eventually combined with EDS chemical microanalysis techniques) to check the filter efficiency or to analyse the material that is captured on the filter.

Most natural and synthetic polymers are good thermal and electrical insulators. This means that when nanofibers or the materials that are commercially developed from nanofibers are scanned by the electron beam in a microscope, sample charging will often occur.





What is sample charging?

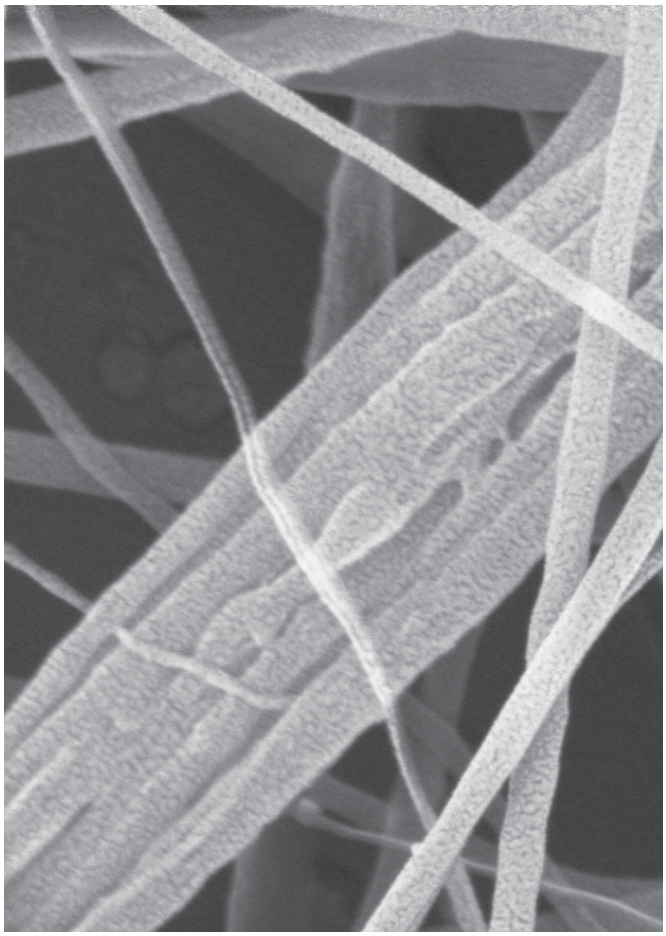
SEM images are generated by scanning an electron beam across the sample. This effectively adds electrons to the sample. Sample charging occurs when samples are bad electrical conductors which means there is no conducting path for electrons to flow from the sample surface towards the sample holder. Sample charging causes all kinds of problems such as drift, blur, and low contrast. In other words, blurry and false images.

By applying a very thin electrically conducting layer of metal such as gold or platinum (a process known as metal coating or sputter coating) onto the surface topography of the specimen, the electrons can flow from the sample surface towards the sample holder and sample charging is prevented. Other positive effects from sputter coating a sample are an improved secondary electron emission, a reduced beam penetration with improved edge resolution and a better protection of electron beam sensitive samples.

Luxor metal coaters are designed to automatically apply a homogeneous and thin metal layer to your SEM samples, protecting them from any charging effects and enhancing the image resolution in your electron microscope.

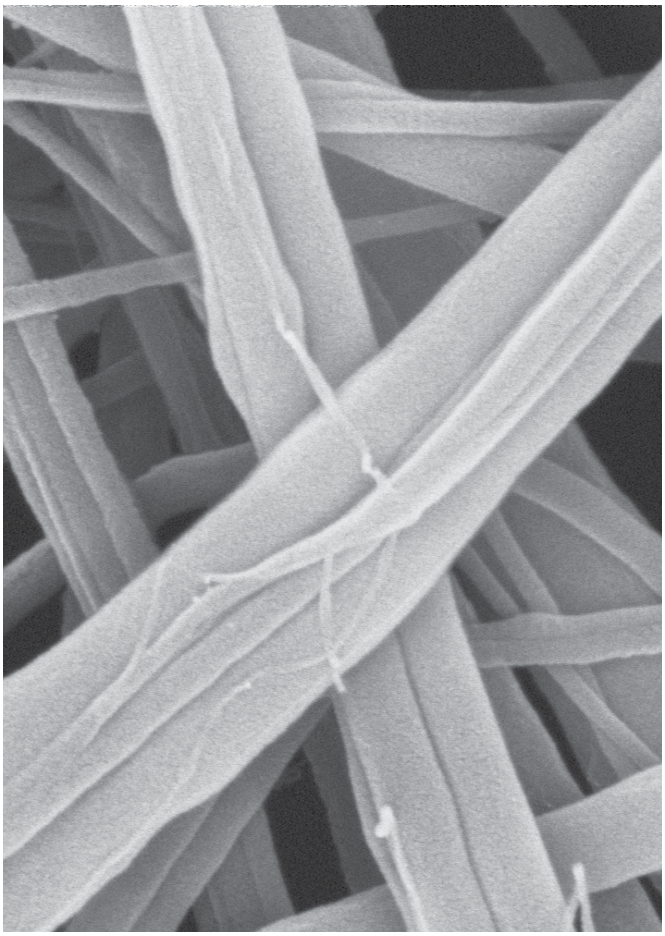
Nanofibers coated

10nm gold layer - 100.000x magnification
(gold particles in the coating are visible)



Nanofibers coated

2 nm platinum layer - 100.000x magnification



Why choose LUXOR?

A² technology: precision coating for high-resolution imaging

LUXOR's unique and innovative A² technology generates a plasma with exceptional precision and control, resulting in a uniformly thin and homogeneous coating. This process begins by creating a vacuum in the chamber, followed by the application of a high voltage. To ensure stability, the resulting coating current is automatically regulated by introducing small amounts of process gas into the reactor, allowing the target current to be reached and maintained.

What distinguishes LUXOR metal coaters from other commercially available instruments is the unique method used to control and adjust this process. For scanning electron microscope (SEM) operators, this means obtaining more consistent and uniform metal coatings, which significantly enhance image quality with higher resolution and contrast. Additionally, the coating process is fully automated, removing the need for manual intervention and allowing for a seamless and worry-free experience.

Innovative upside-down design for greater functionality

At LUXOR, we adhere to a 'form follows function' philosophy, which is why our metal coaters feature a unique design where the samples and target are mounted upside down. While this may seem unconventional at first, it offers several significant advantages.

- **Safety first**
  All voltage and current wires are securely housed within the sputter device, significantly reducing the risk of electric shocks. This safety feature allows you to operate the machine with complete peace of mind.

- **Effortless sample handling**
  The upside-down design makes the lid, which doubles as a sample loading station, easily accessible. This allows you to apply or remove samples quickly, without the need for special tongs or tweezers. This simplicity not only enhances ease of use but also boosts productivity by streamlining the process.

- **Clean coating process**
  This design ensures that loose particles are removed during the coating process, helping to keep your Scanning Electron Microscope (SEM) optimally protected from debris. Consequently, this contributes to more consistent and reliable results.

- **3D coating**
  Additionally, larger particles in the plasma are drawn towards the pump rather than reaching the samples due to their weight, resulting in improved coating quality. This effect, combined with the algorithms of our A² technology, eliminates the need for a rotary or planetary table, greatly simplifying the setup for coating three-dimensional and porous samples.

Fully automated
The coating process is completely automated. Once the samples are loaded, simply select the desired coating thickness and press the start button. This user-friendly system greatly reduces the likelihood of human errors. New operators and lab personnel can learn to operate the device within just a few minutes of basic training.

In our E-BOOK "INTRODUCTION TO METAL COATING TECHNOLOGY FOR ELECTRON MICROSCOPY" you can learn more about sample charging, ways to avoid it, and all there is to know about sputter coating.

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