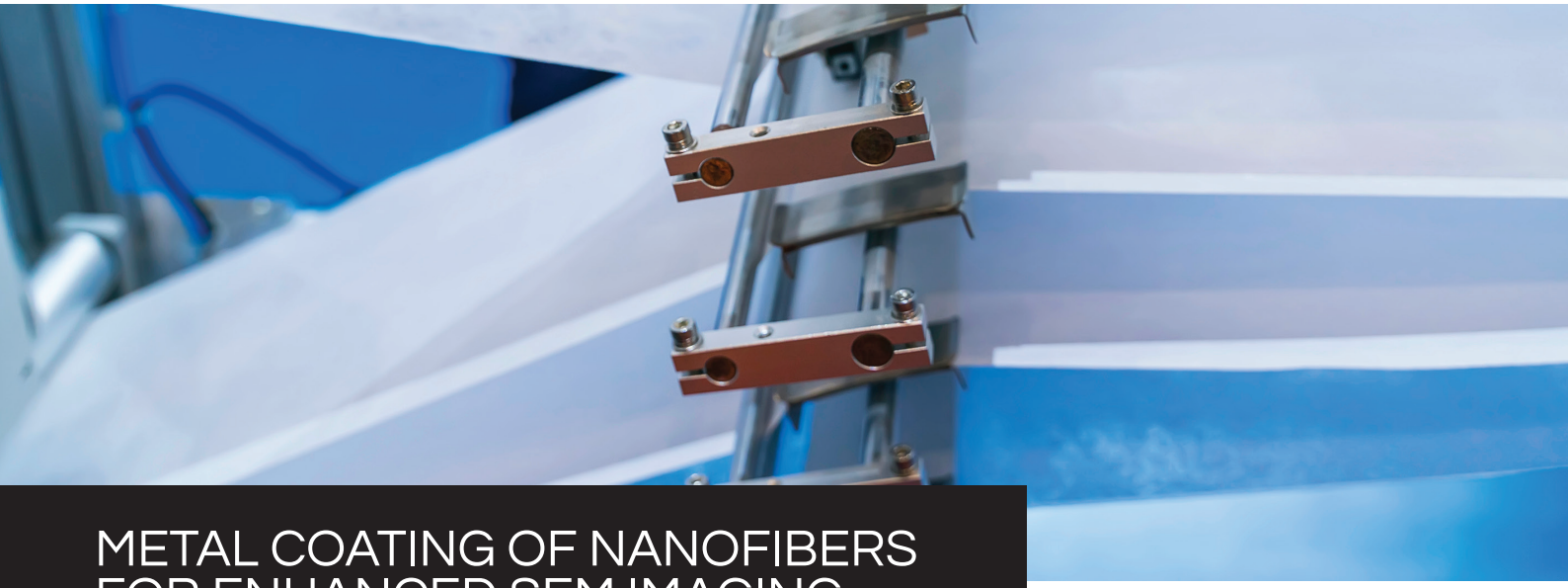
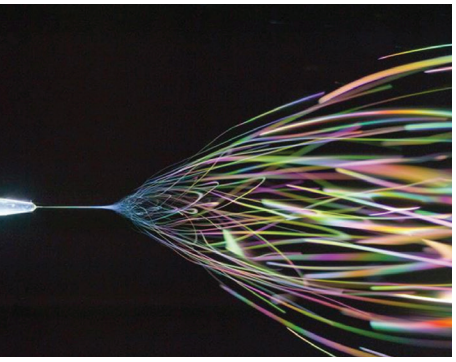
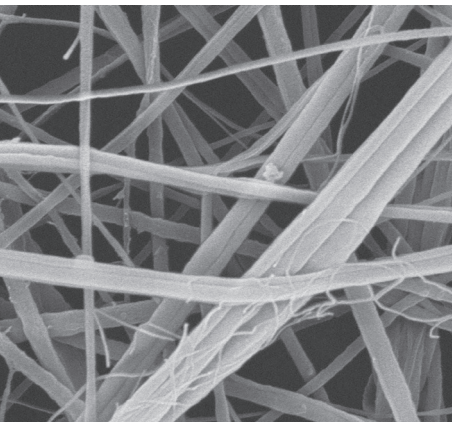


METAL COATING OF NANOFIBERS FOR ENHANCED SEM IMAGING



WHAT ARE 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.

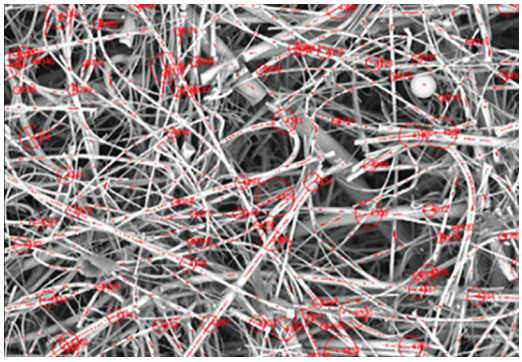


WHERE ARE NANOFIBERS USED?

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?

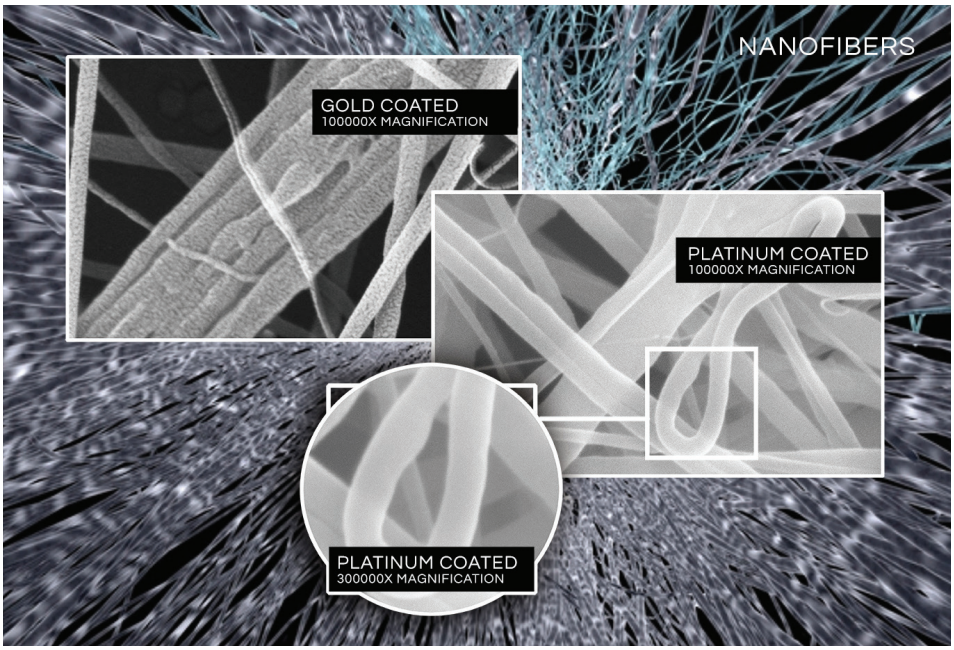


SEM imaging is an ideal tool to check the homogeneity and diameter of nanofibers. SEM manufacturers have developed specific software applications for a fully automatic fiber diameter distribution measurement. Nanofibers are also used in air filtration applications for antibacterial and nanoparticle applications. 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?

What is sample charging and what are the effects of sample charging on SEM imaging, and what are the positive effects of metal sputter coating? 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.

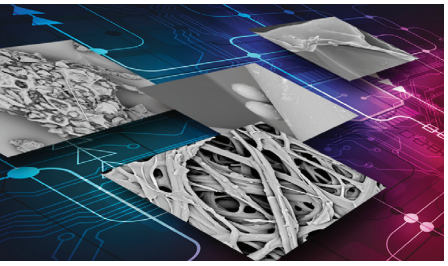


IMAGING AND COATING CONDITIONS

SEM images were recorded with a Thermo Phenom Pharos FEG-SEM desktop electron microscope using the SE detector in high vacuum mode (1 Pa) at 10kV. The “100 000 X magnification GOLD COATED” sample (top left) was coated with a 10nm gold coating in Argon. The “100 000 X magnification PLATINUM COATED” sample (right) was coated with a 2nm platinum coating in Argon. The images show that the grain structure of the gold coating is visible in this range of magnification, and that platinum coating is the preferred solution. Platinum coating creates a much smoother coating surface with a platinum grain size that is invisible in this magnification range. The LUXOR^{Pt} coater used for this application can be equipped with both a gold target for imaging at low resolution and a platinum target for high resolution imaging. Switching between targets only takes seconds. For high magnifications platinum coating would be the preferred solution.

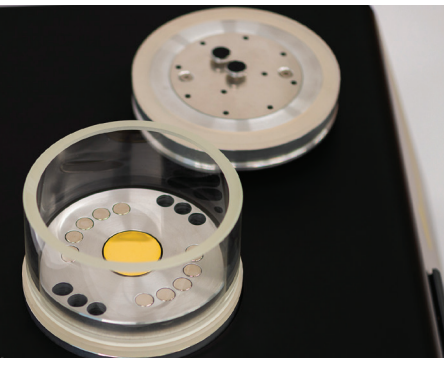
SPUTTER COATING WITH THE LUXOR METAL COATER

LUXOR metal coaters are used extensively in SEM and TEM labs worldwide where image quality and high resolution imaging are of the utmost importance. Metal sputter coating not only prevents sample charging, but also provides improved edge resolution and a better protection of electron beam sensitive samples. Even at relatively low magnifications sample coating offers additional security in a high throughput environment with multiple operators having to provide high quality images in a routine analysis environment on a large variety of samples.



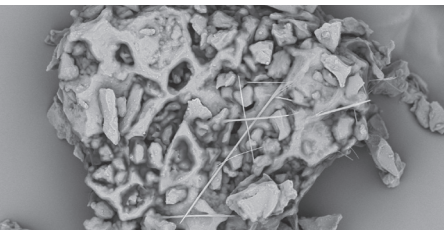
A² TECHNOLOGY

LUXOR's unique A² Technology generates a metal plasma and applies it in a controlled and accurate manner, resulting in an extremely uniform, thin and homogeneous metal layer. The unique way this process is controlled and adjusted is what distinguishes the LUXOR metal coaters from other commercially available instruments. For the SEM operator this means more homogeneous metal coatings, resulting in high resolution and high contrast images and a worry-free coating process without any manual intervention.



UPSIDE DOWN DESIGN

In the LUXOR metal coaters, the samples are mounted upside down. While this might seem a little controversial at first sight, it is actually a consequence of our 'form follows function' approach. In fact, the upside down architecture brings many advantages. First, all high voltage and high current wires are safely hidden within the instrument. This obviously greatly reduces the risk of electric hazards. Next, the sample loading station is easily accessible and allows to apply or remove the samples without the need for special tongs or tweezers. This doesn't just make everyday use easier, but also speeds up productivity. The upside design also makes sure that loose particles will be removed during the coating process. This way, your SEM is optimally protected.



FULL AUTOMATION

The coating process is fully automated. As soon as your samples are loaded into the preparation station, you only have to choose the desired coating thickness and push the start button. Thanks to this user friendly process, the chance of human errors is significantly reduced. Furthermore, this means that untrained operators and lab personnel can operate the device.

Do you want to learn more about how LUXOR metal coaters can help you with your everyday SEM or TEM work?

Visit our website luxor-tech.com
or find a point of sale close to you on our contact page luxor-tech.com/contact