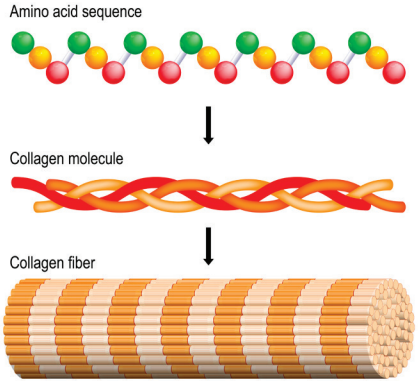
METAL COATING OF BIOLOGICAL SAMPLES FOR ENHANCED SEM IMAGING: COLLAGEN MEMBRANES



WHAT IS COLLAGEN?

Collagen is the main structural protein found in the body's various connective tissues.It is mostly found in tissue such as cartilage, bones, tendons, ligaments and skin. Depending upon the degree of mineralization, collagen tissues may be rigid (bone) or compliant (tendon) or have a gradient from rigid to compliant (cartilage). Collagen is also abundant in corneas, blood vessels, the gut, intervertebral discs, the dentin in teeth, and in muscle tissue.

Collagen is one of the long, fibrous structural proteins. Tough bundles of collagen are a major component of the matrix that supports most tissues and gives cells structure from the outside. Collagen has great tensile strength. Along with elastin and soft keratin, it is responsible for skin strength and elasticity, and its degradation leads to wrinkles that accompany aging.

WHERE ARE COLLAGEN USED?

It also has many medical uses in cosmetic surgery, tissue regeneration, burn surgery and wound healing, which makes it an interesting topic for pharmaceutical and cosmetics R&D labs worldwide.

WHY IS SEM IMAGING USED TO STUDY NANOFIBERS?

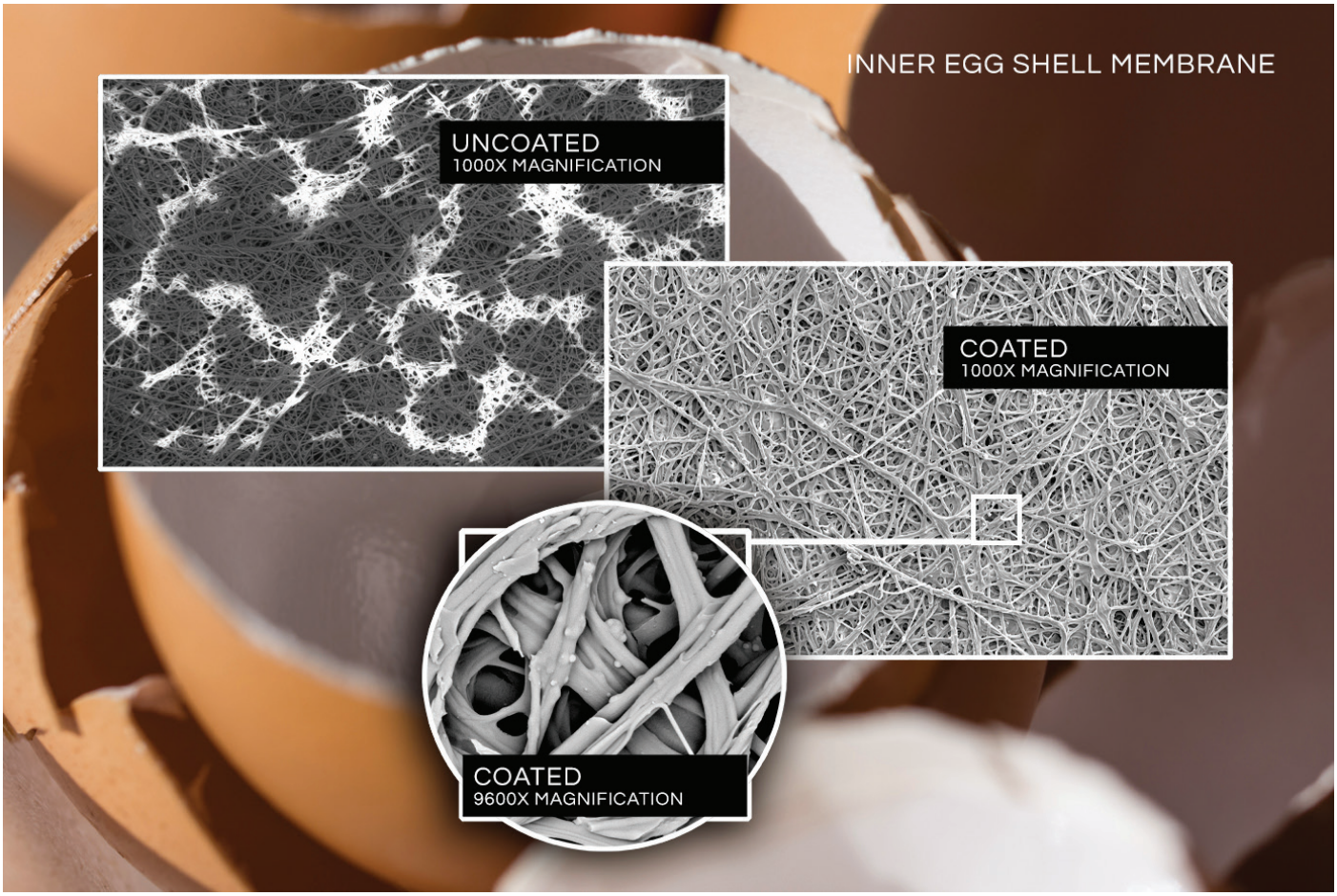
SEM imaging is an ideal tool to check the fiber surface properties and the structure of collagen networks. In general, a lot of organic and biological samples such as tissue, blood vessels and cartilage provide very interesting information when imaged by SEM. Such materials however are very poor electrical and thermal conductors. Hence, they tend to charge heavily when they are scanned by the electron beam in an electron microscope. We used the membrane of an inner egg shell as a source of collagen to investigate the charging in an electron microscope. We noticed that an uncoated collagen sample indeed charges, even at relatively low magnifications. Hence, metal coating was determined as the best solution to image collagen.

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.

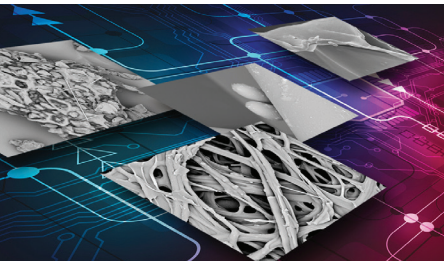


IMAGING AND COATING CONDITIONS

SEM images were recorded with a Thermo Phenom XL desktop electron microscope using the BS detector in high vacuum mode (1 Pa) at 10kV. A 10nm gold coating was applied using the LUXOR^{Au} metal coater.

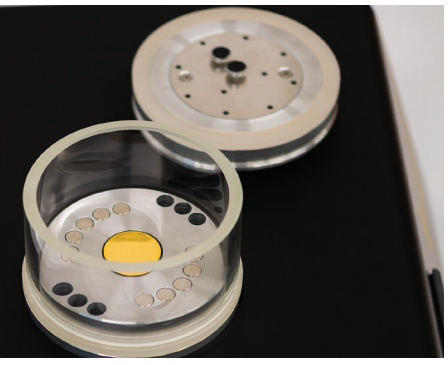
SPUTTER COATING WITH THE LUXOR METAL COATER

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.



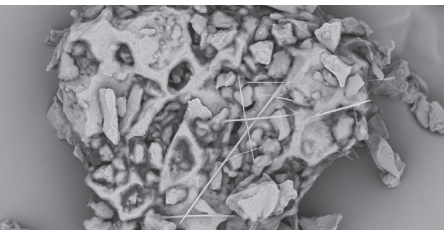
A² TECHNOLOGY

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?

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