

Material Research at DSM

Dr. Arnaud Chiche and Dr. Christa Weber

Excellence in creating innovative products and solutions for customers in Life Sciences and Material Sciences is the key to the success of DSM. One of the key competence centers in R&D at DSM is DSM Ahead, located in Geleen, The Netherlands. The research center supports most of DSM's business entities, including Engineering Plastics, Dyneema, Resins and Nutritional Products.

DSM Ahead offers a wide range of expertise, from chemistry to process technology to material sciences and properties. It also closely collaborates with neighboring departments of complementary expertise, such as Colloids & Interfaces and Analytics.

The challenge

One of DSM Ahead's research topics is nonwovens for filtration. Electrospinning is used to create specific polymer fibers less than 100 nm in diameter. Fiber size and distribution are key factors for filtration performance and are best measured using scanning electron microscopy (SEM). DSM has a central microscopy lab where people can bring their samples for high-end imaging and analysis. The decision was made to purchase a desktop SEM to increase the number of samples screened and allow "in-line" characterization during processing runs. This speeds up the project work and increases the availability of the high-end SEM at the analytical center for more detailed investigations requiring higher resolution and more advanced sample preparation.

Why Thermo Fisher Scientific?

There is no dedicated operator of the desktop SEM, which had to be accessible and easy to use by everyone without extensive training or SEM expertise. The Thermo Scientific™ Phenom Desktop SEM best fitted this profile. The Phenom Desktop SEM is located centrally in the R&D area of DSM, where it is available for all divisions. The Phenom Desktop SEM was bought initially to support the nano-fibers project, but today is used for several

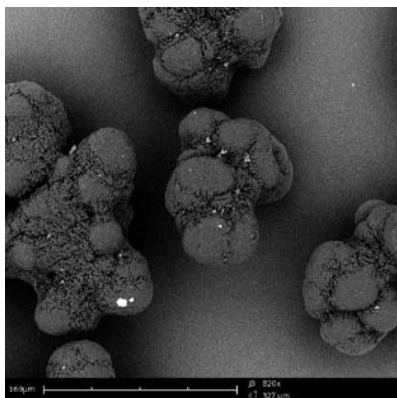
projects in multiple fields. This has proven to be very successful and the number of users has grown to over 30. Among the users are not only technicians but also project leaders and interns.

The solution

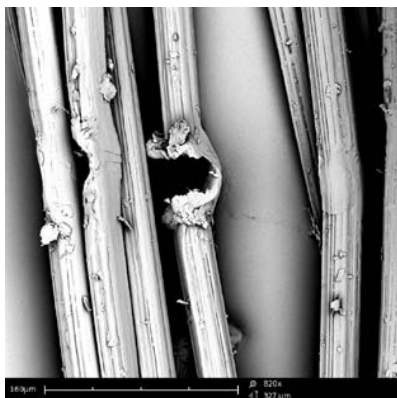
With the growing number of users, the number of different applications for which the Phenom Desktop SEM is used is also growing. Some examples:

- Imaging of drug delivery systems after *in vivo* studies
- Reactor powder morphology
- Abrasion and scratch tests – including level of debris – on coatings, resin and glass
- Process and application impacts on the morphology of Dyneema yarns and tapes
- Filler distribution in composite materials
- Post-mortem fracture analysis (to understand the mechanisms involved)

Every month, DSM organizes a lunchtime meeting where Phenom Desktop SEM users can share their experience and discuss issues and results with microscopy experts from the analytical department. Topics discussed include how to handle specific samples or how to gather the best information. In this way, participants improve and raise their skills to a higher level.

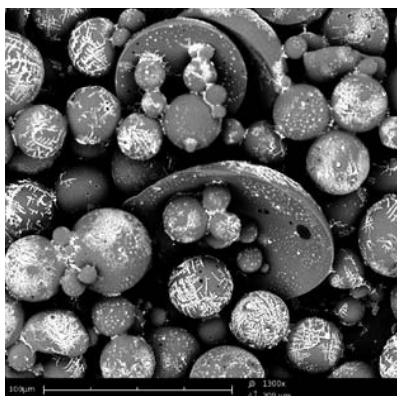


UHMWPE powder particles.

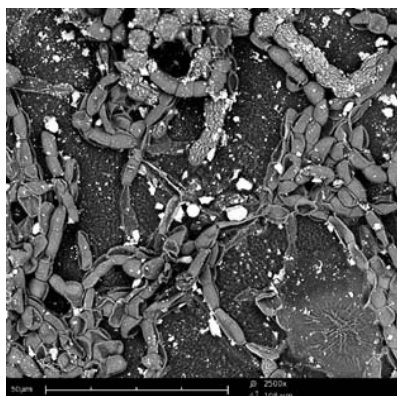


Damaged UHMWPE fibers.

We need to screen many particles at once to check how similar they are. Then we zoom in to further reveal their geometry (left image), and show where the damage lies and whether or not there is any debris (right image).

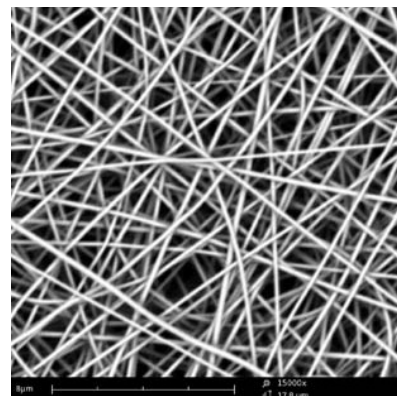


Biodegradable particles used for sustainable drug delivery.



Organic coating contaminated by fungi.

We need to know the particle size and morphology (shape, structure, etc.) and to determine what the surface contamination is. Typically, mesoscopic pictures are required to both answer these questions and to show a representative area.



Polyamide nano-fiber-based nonwoven material prepared by electrospinning.

We need to accurately measure the diameter of enough fibers for the result to be representative. We also need to control the fiber morphology (round, flat, branched or sub-network) and quality.



DSM Ahead

DSM Ahead provides service in the field of manufacturing of polymer materials through compounding and injection moulding; next to that we have a scala of testing equipment for material properties. www.chemelot.nl

Find out more at thermofisher.com/phenom