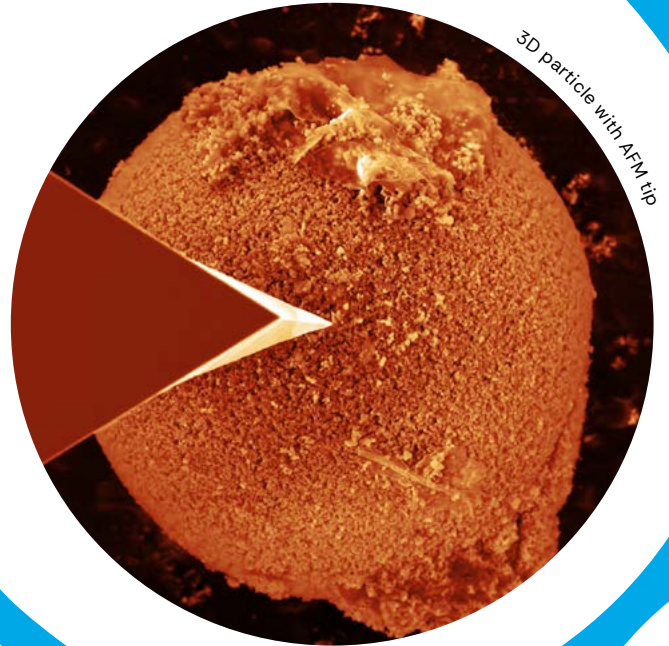


NenoVision



Powders and Particles analyses using AFM-in-SEM LiteScope™

application note



Key added values

- Direct surface roughness measurement
- Texture of bonded functional materials
- Correlation with EDS, SE, BSE, EBIC, ...



Application areas

- Pharmaceuticals – drug delivery
- Ceramics
- Additive manufacturing
- Batteries
- Catalysis in chemical industry
- Paints and coatings of metal components



NenoVision

Powders and Particles analyses using AFM-in-SEM LiteScope™

Powder-to-powder interactions are essential to understand for a wide range of **industrial processes**. Inadequate measurement of **surface roughness** hinders the effects on the material functionality, impeding the design and optimization for specific applications.

Powders and Particles research solution by LiteScope represents revolutionary **“target, click, and measure”** approach, researchers can now streamline complex surface roughness analysis of individual particles, saving valuable time while gaining comprehensive insights.

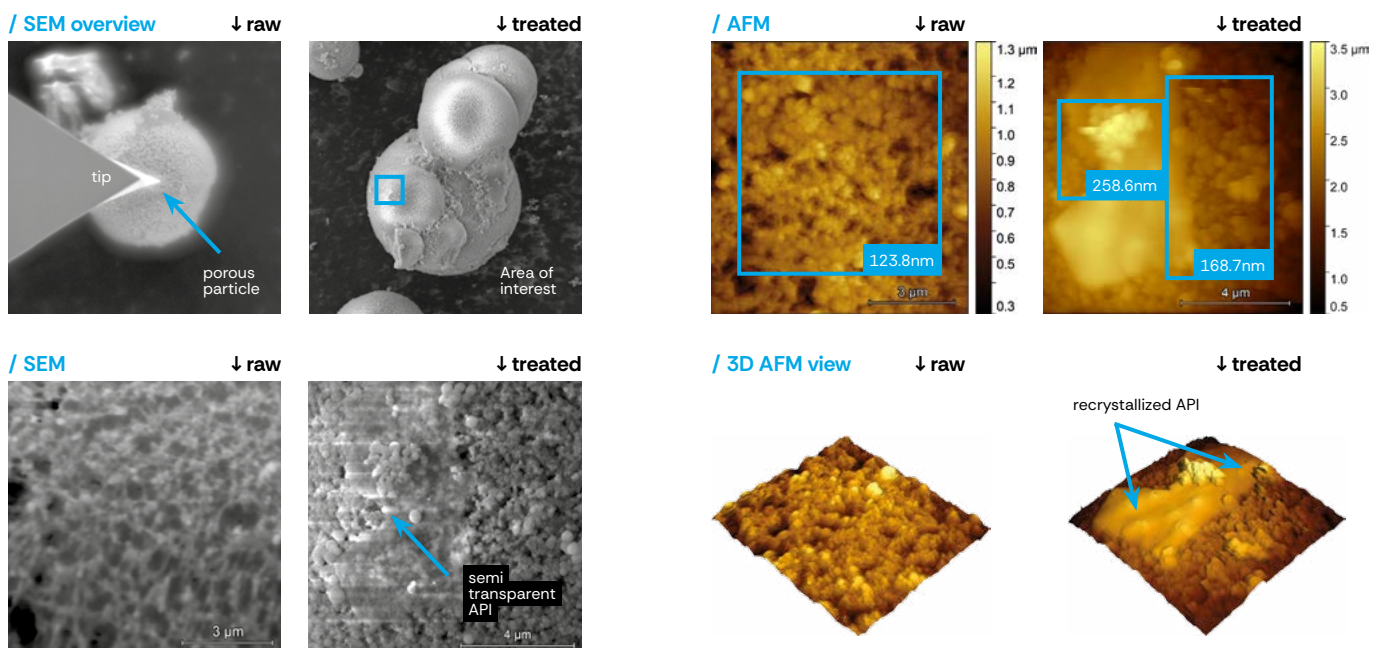
Pharmaceutics

Sample courtesy of David Zůza, Department of Chemical Engineering, University of Chemistry and Technology Prague, CZ.

Mesoporous powder particles are suitable pharmaceutical carriers that can attach an Active Pharmaceutical Ingredient (API) and be used for **targeted drug delivery** into our bodies. Here, we show the direct measurement of the specific **particle surface roughness** with and without API attachment, which leads to a better understanding of surface influence and a **more effective API application** to improve peroral drug delivery processes.

We measured and evaluated the surface roughness of silica particles with different API treatments using AFM-in-SEM. **Comparing the results**, the untreated particles have lower surface roughness than those with API. Even though most of the API treatment was **bound in the pores**, in some parts, the **API recrystallized** and created **API clusters** covering the whole top of the particles.

SEM and AFM images with surface roughness evaluation of raw and treated silica particles.

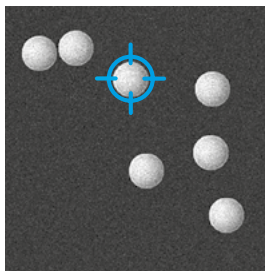


Key benefits and features

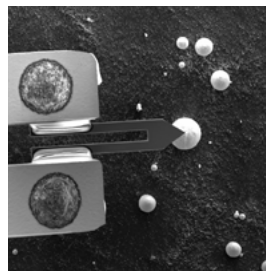
- + Direct topography measurement of individual particles with sub-nanometer precision.
- + Precise localization, texture and decorations analysis of functionalized material attached to the powder or particle.
- + Safe tip navigation to the specific particle by SEM and use of additional SEM techniques to determine particle composition.
- + Time-efficient surface roughness calculation within NenoView software.



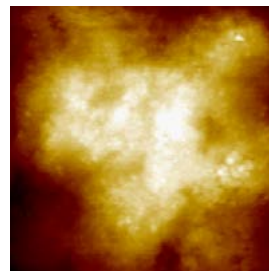
Measurement workflow



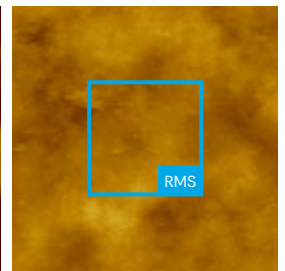
/ Particle Localization



/ Tip navigation



/ Direct topography measurement



/ Surface roughness evaluation

Ceramics

Sample courtesy of Karel Maca, CEITEC BUT, CZ.

Partially **yttrium-stabilized zirconia** ceramic powders have superior mechanical properties. **Understanding of particle surface changes due to fabrication process** can improve the production of ceramic components with more suitable macroscopic properties, such as moldability, durability, flexibility, etc.

We measured AFM topography and calculated the **surface roughness** of the **raw and calcinated ceramic powder**. The calcination process changed the powder surface mainly in the developed interfacial area by **10 % (higher) compared to raw powder**, which corresponds with the **higher flowability** of the powder in macro scale.

Surface roughness analysis of raw and calcinated ceramic powder.

Complex surface analysis	Raw powder	Calcinated powder
	Average	Average
Root mean square height (µm)	0,13	0,11
Developed interfacial area ratio (%)	15	24

raw powder

Similar surface roughness – same number and height of the peaks

SEM

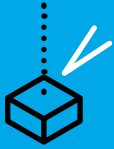
AFM

calcinated powder

Different developed interfacial area – much larger surface area per same distance



LiteScope™ solution for Powders and Particles analyses



Streamlined Workflow

Optimize your processes and experience a workflow that makes your tasks smoother and time efficient.



Roughness Analysis Toolbox

Access a dedicated toolbox for accurate particle surface roughness analysis, including background corrections to simplify complex calculations.



Data export functionality

Fast and effortless data export for further processing and reporting, making it simple to share your findings and collaborate effectively.



Software layout and UX

Built-in software

enables to determine the roughness of the sample surface and fast export of analyzed data.

Choose a suitable background fit

- Polynomial
- Spherical

Select surface roughness calculation

- the area
- parameter

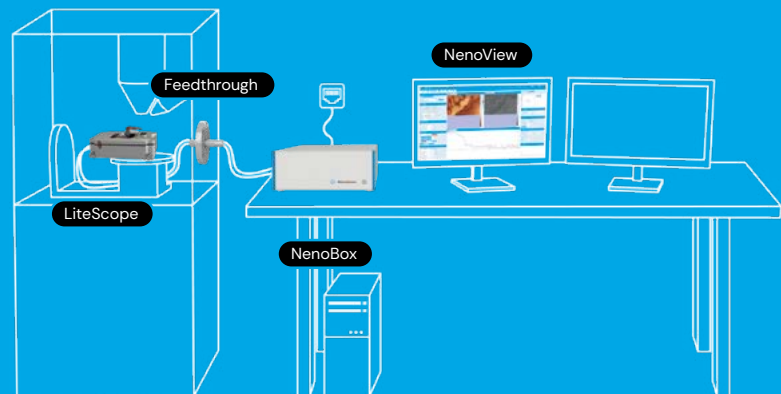
Export data

- .txt
- .png

LiteScope Setup →

NenoVision combines tradition and expertise with unique solutions in nanoscale AFM-in-SEM microscopy.

Thanks to its optimized design, the AFM LiteScope seamlessly integrates into most SEM systems produced by Thermo Fisher Scientific, TESCAN, ZEISS, Hitachi, Jeol, and their accessories.



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