# SEM Sample Preparation Products

Redesign > Pursuing Scenario BKM Solutions

SuPro Instruments

http://www.suproinst.com

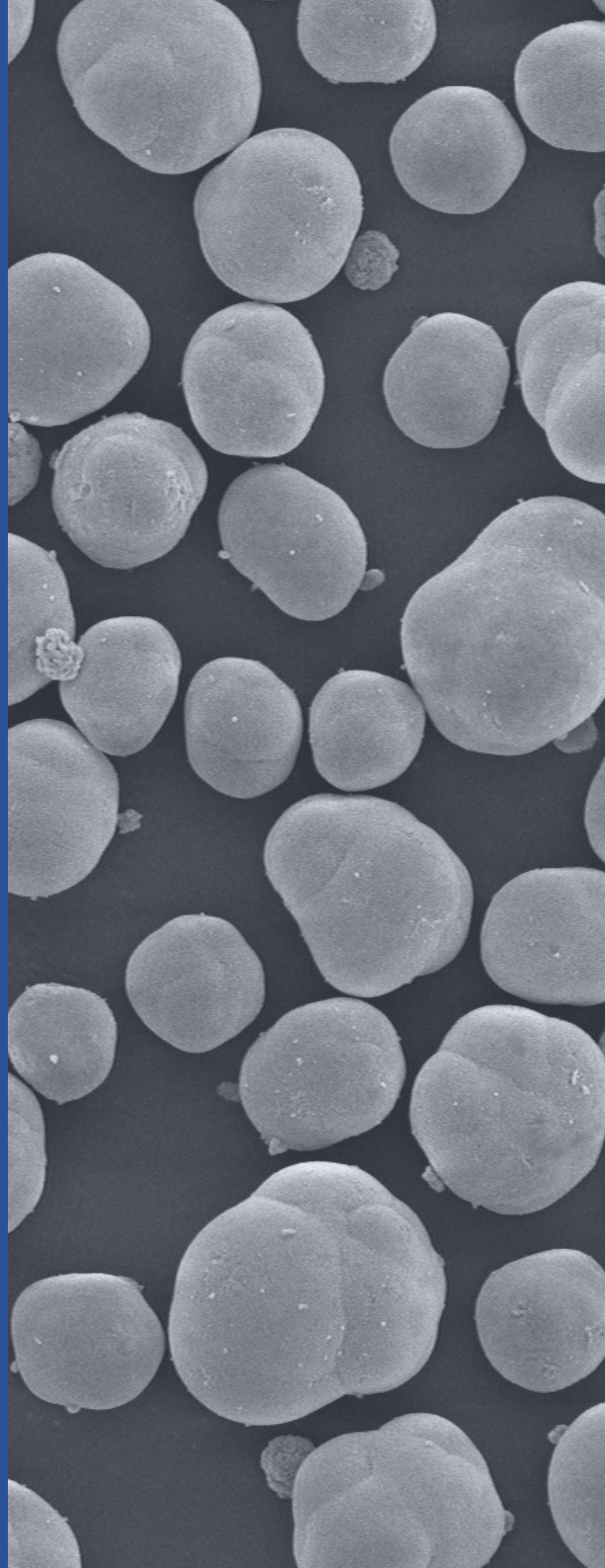
# SEM Sample Preparation Faces Greater Challenges

In the past 20 years, the resolution of electron microscopy has continuously improved, with magnification increasing from tens of thousands to hundreds of thousands. In order to achieve the best performance of scanning electron microscopy (SEM), new challenges have been posed to sample preparation techniques.

With the vigorous development of new materials, new energy, microelectronics, and biology, especially various micro-nano structures such as powders, polymer thin films, and 3D samples, there is a greater challenge in balancing charging effects and high resolution in electron microscopy characterization. Additionally, there is a need for more precise handling of temperature-sensitive or plasma-sensitive samples.

To adapt to different application scenarios, it is imperative to develop more intelligent, convenient, and universally applicable sample preparation instruments and process solutions.

Therefore, we comprehensively consider performance parameters, user experience, price, product reliability, and process scalability from multiple dimensions, striving to provide the Best Known Method (BKM) solutions in corresponding scenarios, making SEM sample preparation simpler and more worry-free, allowing researchers to focus more on exploring new worlds.

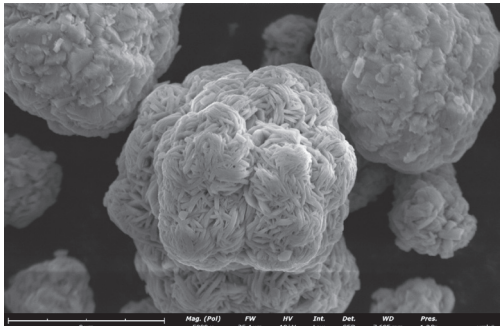


# Filament SEM Scenario

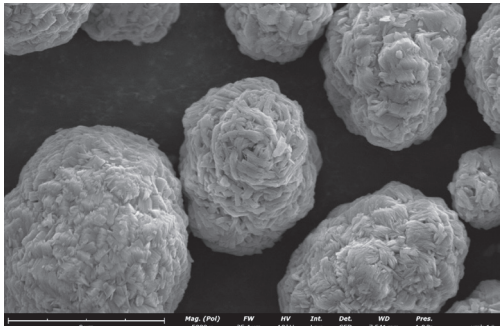
In the past decade, with the optimization of tungsten filaments and electronic circuits, especially the use of compound filaments, the resolution of filament electron microscopes has been further improved, from typical magnifications of several thousand times to several tens of thousands of times, even reaching the level of traditional entry-level field emission microscopes.

Correspondingly, ion sputtering instruments have also upgraded from diode sputtering to mainly magnetron sputtering. Typically, for magnifications less than 20K times, gold (Au) deposition is mainly used, and in the range of 20K to 100K times, platinum (Pt) deposition is mainly used, which is sufficient to handle most filament SEM scenarios.

To address the increasing number of 3D sample scenarios (powders, particles, porous materials, fibers, etc.), we have independently designed a digital rotary-tilting sample stage, which ensures more uniform film deposition and enables three-dimensional angular rotation deposition, solving the problem of side coating for samples. It is especially friendly for 3D powder and porous sample SEM preparation.



Au coating without rotary-tilting sample stage



Au coating with rotary-tilting sample stage

For NCM precursor samples, if Au is sputter coated without using the rotary-tilting sample stage, the SEM image still has charging effects. By using the rotary-tilting sample stage to maintain rotation and tilt angle during Au sputtering, the charging effects in the SEM image under the same conditions disappear.

## Ion Sputter Coater
## Mini Coater


Metals that can be deposited: Au, Pt and Pd

1. Magnetron sputtering cathode technology: fine deposition without thermal damage
2. Touch screen automatic control: convenient and time-saving to use.
3. Digital rotary-tilting sample stage: 3D sample deposition

### Digital Rotary-tilting Sample Stage

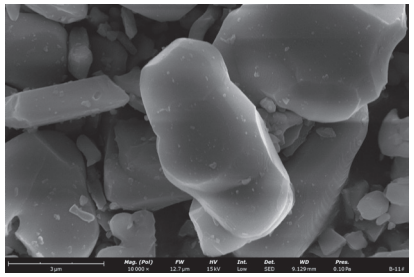
1. It can simultaneously achieve rotation and tilting, resulting in more uniform deposition without blind spots.
2. Z-axis height adjustable to adapt to different sample heights and maintain reproducibility of deposition parameters.
3. Angle and rotation speed can be displayed digitally, making it convenient and easy to use.

# FE-SEM Scenario

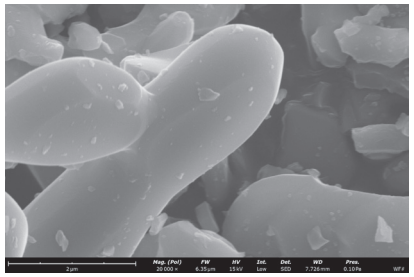
Field emission scanning electron microscopes (FE-SEMs) have higher resolution compared to filament SEMs, with magnifications reaching up to 100K times. This poses higher demands on the particle size of the sputter coating instrument, requiring fine particles that do not cover the sample surface and provide improvements in charge elimination and contrast enhancement.

The conventional approach for sample preparation in FE-SEMs is sputter coating with Pt metal. However, the conductivity and electron signal excitation capability of Pt is not as good as Au, especially in 3D powder, porous, and membrane sample scenarios where Pt deposition alone is not sufficient.

Therefore, we have designed a dual target ion sputter coater and developed a layering process: first sputtering a layer of Pt and then a layer of Au. This layered sputter coating mode effectively suppresses the formation of Au islands, while also considering conductivity and particle size, resulting in excellent charge elimination and contrast enhancement for powder and membrane samples.

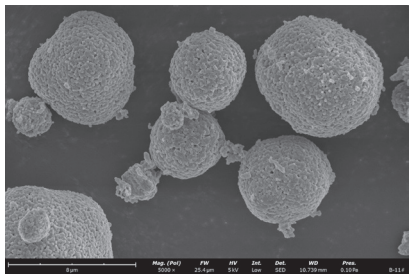


Pt coating

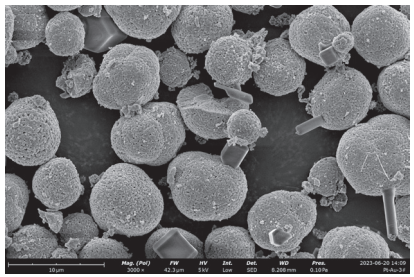


Pt-Au layered coating

$Al_2O_3$ powder is a sample with poor conductivity and is prone to charging. When Pt is sputtered alone under the same conditions, the charging is not eliminated. However, when Pt-Au layered alloy is sputtered, the charging is eliminated.



Pt coating



Pt-Au layered coating

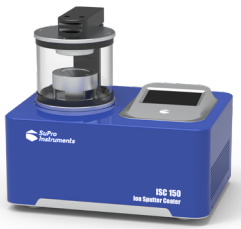
For NCM precursor powder samples, both Pt and Pt-Au layered alloy sputtering eliminate charging under the same conditions. However, the morphology contrast of the Pt-Au alloy samples is significantly better than those sputtered with Pt alone.

# Dual Target Ion Sputter Coater J20


Metals that can be deposited:
Au, Pt and Pd.
An alloy of arbitrary composition: Pt-Au, Pt-Pd, etc.

1. Dual-target magnetron sputtering cathode: no need to change targets, a unique layered sputtering process.
2. Touch screen automatic control: convenient and time-saving to use.
3. Digital rotary-tilting sample stage: 3D sample deposition.

Alternative Solution:




Single-target
Ion Sputter Coater
ISC150

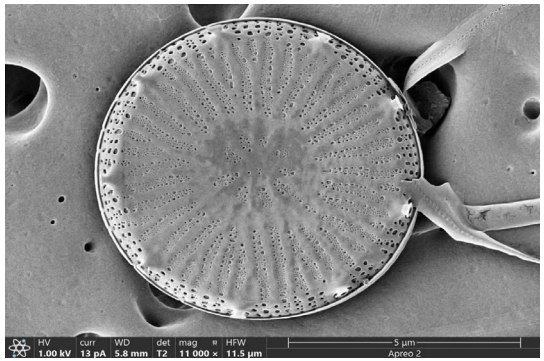
Large chamber
constant pressure sputtering

# Ultra-high Resolution FE-SEM Scenario

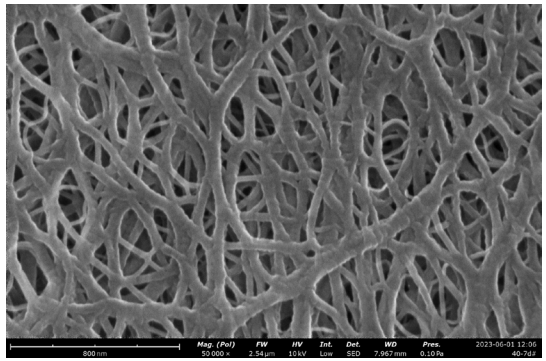
Ultra-high resolution field emission SEM can achieve a magnification of up to 200K to 300K times, which imposes more stringent requirements on the particle size of spray-coated metals. Conventional Pt or Pt-Pd alloy schemes are no longer able to meet these requirements satisfactorily, and higher melting point Ir targets are too expensive. Therefore, high melting point metals such as W and Cr with smaller particle sizes are highly favored. However, due to their active chemical properties, W and Cr require higher vacuum conditions for sputter coating.

Therefore, we have designed a dual vacuum mode dual-target ion sputter coater, which takes into account the timeliness and convenience of low vacuum mode spray coating with inert metals such as Pt or Au and can also introduce Ar gas for coating W, Cr, Ag, Ti, Cu, C and other easily oxidizable materials in high vacuum mode. Moreover, it can achieve alloy film spray coating using unique layering or co-sputtering modes, resulting in higher compatibility with various SEM sample preparation scenarios.

| Dual vacuum mode | Dual target design | Rotary-tilting sample stage |
|---|---|---|
| 1. High vacuum mode: ultimate vacuum degree less than $10^{-3}$Pa.<br>2. Low vacuum mode: fast and convenient. | 1. No need to change target materials.<br>2. Any component alloy sputtering.<br>3. Unique layered sputtering process. | 1. Revolution + Rotation + Tilting<br>2. Z-axis height adjustable, flexible for different height sample coating. |



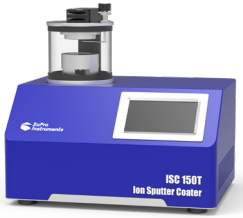
Pt Coating-diatom



Pt-Au layered coating-PI separator

## High Vacuum Dual Target Ion Sputter Coater J20T


Materials that can be deposited:
Precious metals such as Pt, Au, Pd and Ir.
High melting point and easily oxidizable target materials such as W, Cr and C.
Monometallic or alloy materials such as Ag, Ti and Cu.
1. Dual vacuum coating mode: high flexibility and convenience of use.
2. Dual-target magnetron sputtering cathode: no need to change targets, a unique layered sputtering process.
3. Digital rotary-tilting sample stage: 3D sample deposition.




Alternative Solution:

Single-target
Ion Sputter Coater
ISC150T
Compact, oil-free cleanliness

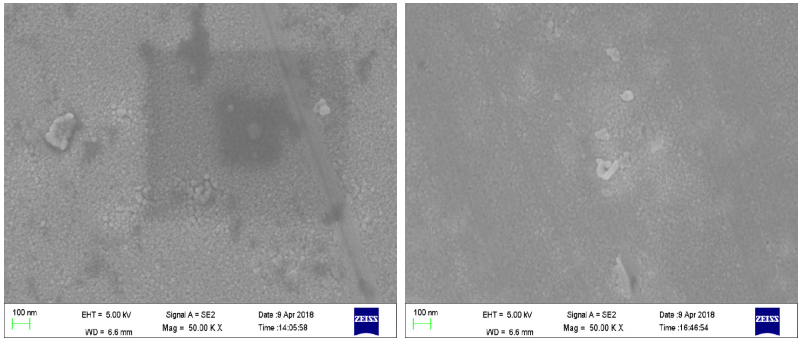
# SEM Imaging Pollution Problem

## Remote Plasma Source RPS50

### SEM Chamber Cleaning

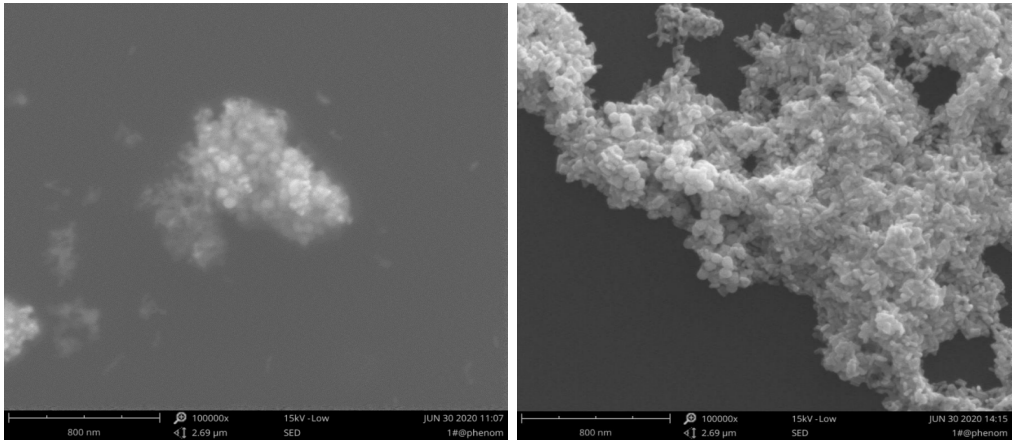
RPS50 can generate active oxygen or hydrogen radicals, which react chemically with hydrocarbon contaminants on the sample surface and inside the SEM chamber, producing gases such as $CO_2$ and $H_2O$, which are then pumped out by the vacuum pump. This ultimately achieves the purpose of cleaning carbon accumulation on the sample, while improving imaging resolution and contrast, and shortening the pumping time of the SEM chamber.

RPS50 is compatible with most mainstream SEM and FIB brands.



Before cleaning　　After cleaning

After cleaning the SEM chamber with RPS50 for 60 minutes, carbon accumulation near the $SiO_2$ fiber disappeared.



Before cleaning　　After cleaning

After Coolglow plasma cleaning, the details of nanoparticles were clear, and the visual resolution was significantly improved.

### SEM Sample Pretreatment

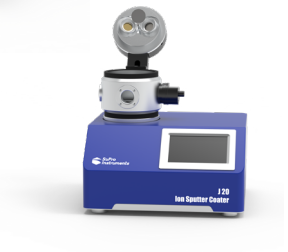
## Glow Discharger Coolglow

Coolglow uses RF plasma to clean the sample surface and remove hydrocarbon contaminants, making SEM imaging clearer and helping to maintain the long-term cleanliness of the SEM chamber. In addition, it can also perform hydrophilic treatment on the sample.

# Product Selection Guide

1. Filament SEM scenario
   - Recommended model: Mini Coater

2. FE-SEM scenario
   - Recommended model: J20

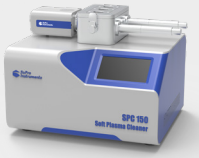


3. Ultra-high resolution FE-SEM scenario
   - Recommended model: J20T

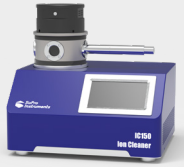
4. Cleaning of hydrocarbon contaminants in SEM or FIB chambers
   - Recommended model: RPS50

5. Cleaning of sample  hydrocarbon contaminants or hydrophilic treatment
   - Recommended model: Coolglow

## TEM Sample Preparation Product Series



SPC150



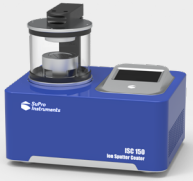
IC150

THS 05

THS 05T

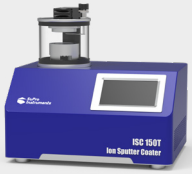
## SEM Sample Preparation Product Series

Mini Coater



ISC150

J20



ISC150T

J20T

RPS50


Coolglow

Supro Instruments is headquartered in the Nanshan District of Shenzhen and has offices in Beijing and Suzhou. The company has obtained certifications such as ISO9001 production system certification, CE certification, national high-tech enterprise certification, and specialized and new certifications. The company has a team of members who are passionate about product design and instrument development, with the core team coming from the Chinese Academy of Sciences system.

Supro Instruments is committed to providing lean-level preparation, measurement, and control instruments for electron microscopy sample preparation and micro-nano thin film fields, assisting customers in improving research and development and production efficiency, and providing customers with a better user experience.

For more information, please visit our website: www.suproinst.com

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