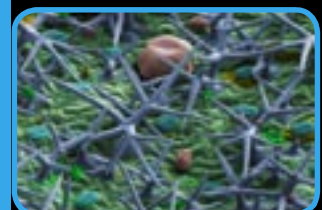
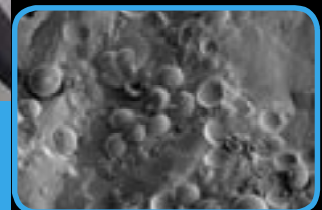


# PP3000T

Cryo-SEM comes of age



- Recipe driven touch-screen interface
- Fully automated
- Highest performance on a wide range of specimens
- Superb specimen visibility
- Efficient cooling with all-day hold times
- Specialist support and three year warranty

Q



## Why cryo-SEM?

Cryo preparation techniques for scanning electron microscopy (SEM) are essential for the observation of wet or beam-sensitive specimens. Cryo-SEM removes the need for sometimes 'specimen unfriendly' conventional preparation techniques, such as critical point drying and allows observation of the specimen in its 'natural' hydrated state.

### Limitations of conventional 'wet' processing

- Shrinkage and distortion
- Relocation and extraction of soluble materials
- Mechanical damage (fragile specimens are easily damaged during critical point drying)
- For biological material toxic reagents are required (fixatives, buffers etc)
- Long processing times

### Advantages of cryo-SEM

- Specimen viewed in its fully hydrated state
- Soluble materials are retained
- Little or no mechanical damage
- Ideal for time resolved experiments (biological and industrial)
- High resolution capability (compared to low-vacuum techniques)
- Extra information obtained by low-temperature fracturing
- Excellent for liquids, semi-liquids and beam sensitive specimens
- Rapid process – typically 5 - 10 minutes

## PP3000T overview

The PP3000T is a "great leap forward" in cryo-SEM technology – combining the highest quality results with unparalleled ease of use.

The PP3000T is a column-mounted, gas-cooled cryo preparation system suitable for SEM, FE-SEM and FIB/SEM. Control is via a large and intuitive touch-screen mounted on the spacious Prepdek™ workstation, giving the operator instant access to, and control of, all the operating parameters.

Visibility is a key feature throughout the whole system. Chamberscope images from the preparation chamber and the SEM are displayed on the control screen. Five preparation chamber viewing windows give unsurpassed visibility of the specimen and chamber interior. The chamberscope window is protected by an automatic shutter to prevent build-up of sputtered material.

The PP3000T includes facilities needed to rapidly freeze and transfer specimens. The cryo preparation chamber has tools for cold fracturing and fully automatic controlled sublimation and specimen coating. Once prepared, the specimen can be transferred onto a highly stable SEM cold stage for observation. Efficient cold trapping in the cryo preparation chamber and SEM chamber ensures the whole process is frost free.

### Specimen holders

The standard universal specimen stubs supplied with the PP3000T include surface holes, slots and a flat area – ideal for most applications. A range of additional holders is also available, including special top loading clamping holders for high pressure freezing rivets and planchettes.



## Prepdek™ workstation and touch-screen user interface

The PP3000T is controlled using an intuitive colour touch-screen, mounted on the user-friendly Prepdek™ workstation. The touch-screen allows user defined recipes to be rapidly entered and stored for instant access. The screen can be set to suit different operator levels and preferences (e.g. analogue or digital vacuum measurements). Chamberscope images of both the preparation chamber and SEM cold stages are displayed and at-a-touch can be expanded to fill the screen.

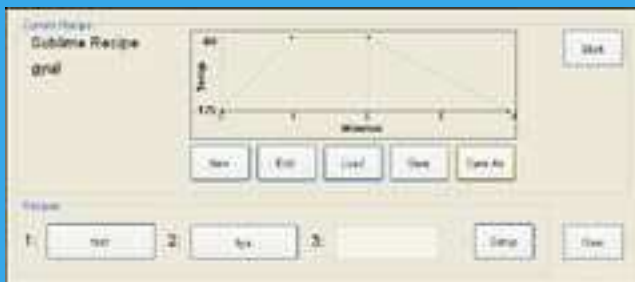
Although many of the key steps in the specimen preparation process are automated (airlock pumping, sublimation, sputter coating etc), further help is instantly available through user-friendly videos. These guide the operator through the system set up and then each specimen processing step in a concise and logical way.



Main display screen with all operational parameters visible to the user at all times



Password protected service screen gives the operator instant access to the system diagnostics



Sublimation parameters for temperature and time can be pre-set and stored



Sputtering parameters (time and current) can be pre-set and stored

### Handling and transferring specimens

The PP3000T Prepdek™ workstation is fitted with a slushy nitrogen freezing station, connected to the pumping system. Rapid freezing reduces ice crystal damage which results in enhanced ultra-structural preservation.

For handling pre-frozen material, the Prepdek™ is also fitted with the Advanced Specimen Handling System. This allows specimens that have been frozen by alternative freezing methods (or stored field specimens) to be manipulated in liquid nitrogen and then transferred under vacuum into the PP3000T preparation chamber for subsequent processing and observation.

The vacuum transfer device is compact, vacuum tight and has a convenient bayonet connection to the specimen shuttle to ensure rapid transfer. In line with the automatic design of the PP3000T, when the vacuum transfer device is located on to the preparation chamber, the airlock is automatically pumped.

## Cryo preparation chamber

The PP3000T preparation chamber is connected directly to the SEM and includes facilities for preparing a wide range of specimens.

Specimen stage cooling is by an integral liquid nitrogen dewar which has an all-day run time on a single fill (0.75L) of liquid nitrogen. The cold stage is connected directly to the dewar and includes a heater and sensor to precisely control the temperature from  $>+50^{\circ}\text{C}$  to  $-190^{\circ}\text{C}$ . Comprehensive cold traps surround the cold stage.

### High visibility

The PP3000T has superb chamber visibility. In addition to the large front window there are additional top and side windows. The specimen stage is lit by four LEDs.

A chamberscope allows the specimen stage to be viewed on the control touch-screen.

Twin fracturing manipulators (actively cooled) allow a range of specimen types to be fractured.

### Automatic sublimation and sputtering

Sublimation and sputtering are fully automatic. The high resolution sputter coater is specifically designed for cryo applications and will give fine grain films that are essential for FE-SEM applications. A platinum target is fitted as standard; other metals include Au, Au/Pd, Cr and Ir. An optional carbon fibre evaporation head can be fitted.

### Cryo preparation chamber pumping

The preparation chamber is pumped by a remotely positioned 70L/s turbomolecular pumping system. Typical preparation chamber vacuums during operation are in the region of  $10^{-6}$ mbar or better. Positioning the turbomolecular pump away from the SEM ensures total elimination of mechanical vibration and significantly reduces the cryo system mass that is connected to the SEM. A vacuum buffer tank allows the rotary pump to be automatically switched off for most of the system run-time.

The pumping system is connected to the preparation chamber by a stainless steel bellows.

## SEM cold stage and cold trap and cooling system

A highly stable, thermally isolated, nitrogen gas cooled stage attaches to the SEM stage. The SEM stage and cold trap are cooled by two separate cold gas circuits – both capable of reaching temperatures down to  $-192^{\circ}\text{C}$ . This configuration allows the operator to select stage and cold trap temperatures that are optimized for specific specimens.

### Off-column cooling

The cold nitrogen gas cooling dewar for the SEM stage and cold trap is remotely positioned (typically on the floor behind the SEM). The system will run for up to 24 hours between fills.



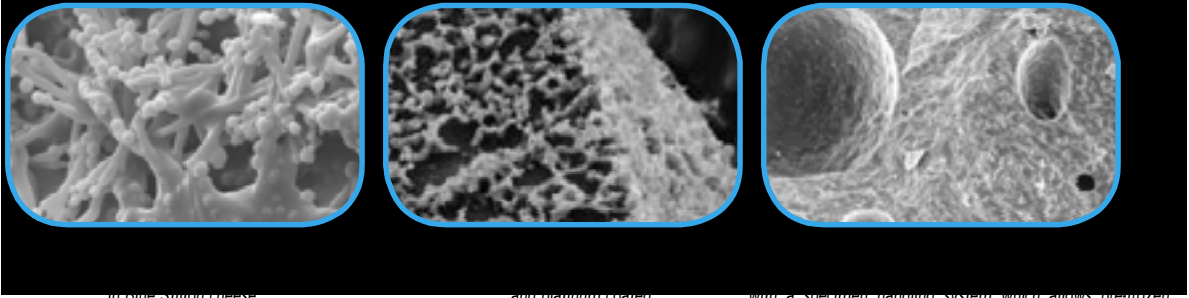
# PP3000T Specification

<b>Inside the SEM:</b>	<p>Nitrogen gas cooling — rapid specimen stage cooling after sublimation, possible with conduction cooling</p> <p>Independent cooling of the SEM cold stage and cold trap</p> <ul style="list-style-type: none"><li>— flexible, efficient cold trapping</li></ul> <p>Stage and cold trap cooling down to -192°C</p> <ul style="list-style-type: none"><li>— not possible by conduction cooling</li></ul> <p>SEM chamberscope and LED illumination</p> <ul style="list-style-type: none"><li>— excellent visibility for specimen exchange</li></ul>
<b>SEM cooling:</b>	<p>Remote, off-column 12 litre cooling system with over 24 hour hold time</p> <ul style="list-style-type: none"><li>— fill and forget, overnight operation possible</li></ul>
<b>Column mounted preparation chamber:</b>	<p>Cold stage -190°C to +60°C</p> <p>Cold stage parking space for a second specimen shuttle</p> <ul style="list-style-type: none"><li>— faster specimen processing</li></ul> <p>Comprehensive cold trapping — clean contamination-free operation</p> <p>Multiple LED illumination</p> <ul style="list-style-type: none"><li>— clear view of specimen with no shadows during fracturing</li></ul> <p>Actively cooled, micrometer driven fracturing knife and probe</p> <ul style="list-style-type: none"><li>— side mounted probe can be fitted with a range of scalpel blades to suit different specimen needs</li></ul> <p>Chamberscope — large view of specimen on the display screen, cumbersome binocular not needed</p> <p>Non-boiling cooling dewar with all-day run time — fill and forget</p> <p>Large front window (138 x 73mm) plus top and side viewing ports — excellent specimen visibility</p> <p>Automated sublimation via user recipes — optimum control of this important process</p> <p>Automated, low energy sputter coater — fine grain, high resolution coating</p> <p>Shuttered window — chamberscope port is automatically shielded during coating to ensure the window remains free of sputtered metal</p> <p>Fully interlocked valve system with status lamps — safe operation</p> <p>Film thickness monitor (option)</p> <p>Carbon fibre evaporation attachment (option)</p>
<b>Preparation chamber pumping system</b>	<p>Floor-mounted turbo pumping with anti-vibration block and stainless steel vacuum connection to the preparation chamber — reduced mass on the SEM</p> <p>Base vacuum 10<sup>-6</sup>mbar or better — high vacuum compatibility with SEM chamber</p> <p>Integral buffer tank — allows rotary pump to be automatically switched off for most of the time</p> <p>Single 90 L/m rotary pump required, dry pump available</p>
<b>Touch-screen control — user definable recipes and operator levels</b>	<p>Multi-ability user interface screen — ideal for beginners and experienced users</p> <p>Quick overview of system status — all the important operating data can be seen “at a glance”</p> <p>User defined “recipes” can be stored — reproducible results from a range of specimen types</p> <p>Quick access to videos outlining preparation techniques and system maintenance — instant help at every step</p>
<b>Dual slusher PrepDek<sup>®</sup> specimen preparation station:</b>	<p>Twin liquid nitrogen slushing and specimen handling system</p> <ul style="list-style-type: none"><li>— ideal for handling pre-frozen specimens</li></ul>



## Food science

Cryo-SEM has for many years been an important technique in food science. Microstructure has a direct influence on the taste, texture and consumer preference.



in Blue Stilton cheese

and platinum coated

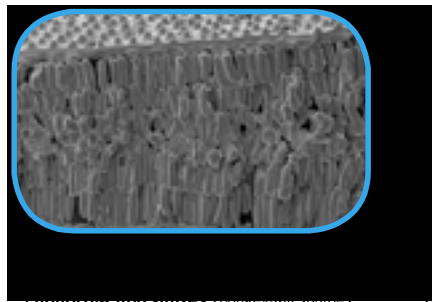
with a specimen handling system which allows pre-frozen material, such as ice cream, to be manipulated and then transferred under vacuum into the cryo preparation chamber

## Biology

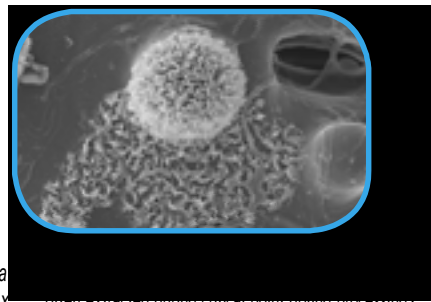


thin across and arranged in characteristic hexagonal arrays. Specimen cold fractured and sputtered with 4nm of platinum

the fungus colonizes the host plant root system. Mycorrhizae are an important component of soil life and soil chemistry



*Euphorbia myrsinites* (donkey tail spurge)

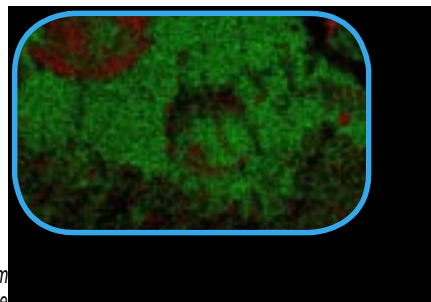


Wax (Waxes) often extracted during critical point drying processing

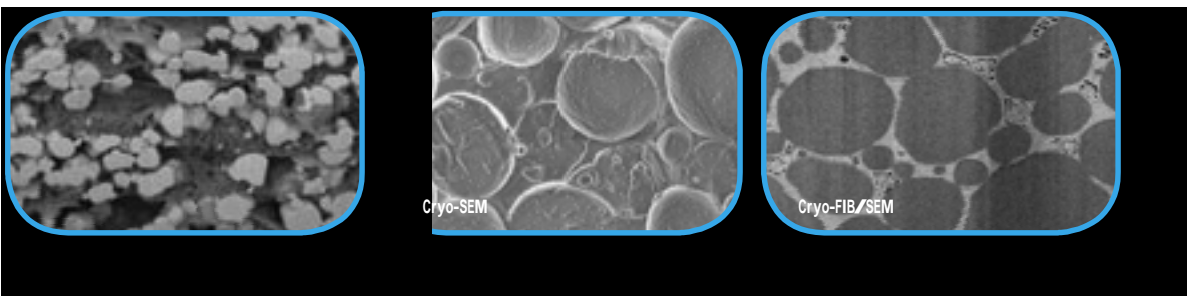
## Materials



and oil. Dark grey bubbles are dried oil droplets in brine-filled cracks



differentiate oil from water content (green: oxygen, red: carbon)



Cryo-FIB/SEM section of a ceramic matrix, laminated polymer. A combination of hard and soft materials FIB-cut without damage or distortion. 2kV secondary electron image.

Comparing a cryo-SEM prepared specimen with cryo-FIB/SEM. Both images show large oil droplets, with the cryo-FIB/SEM image clearly demarcating the water phase (light areas) and additives (dark areas within the ice)

# Ordering Information

NB: For a full quotation, including on-site installation and customer training, please contact us or our local distributor

## PP3000T

Cryo-SEM preparation system for SEM, FE-SEM and DualBeam applications.

Including: column-mounted cryo-preparation chamber with off-column turbo-pumping system. SEM cold stage and cold trap, Prepdek™ workstation with dual freezing and specimen manipulation facilities, touch-screen user interface mounted on the Prepdek™ workstation. Transfer device, 2 x AL200077B and 1 x 10246 specimen shuttles, E7449-5 and E7402 specimen stubs. Microscope interfaces, start up kit and operation manual.

<b>Pumping</b>		The PP3000T requires one 90L/m rotary pump (dry pumps available on request)
	<b>EK3180</b>	RV5 90 L/m 115/230V 50/60Hz vacuum pump with oil mist filter
<b>Options and accessories</b>	<b>PP7450</b>	Pressurised dewar (30L) for LN <sub>2</sub> storage and venting gas supply
	<b>PP10998</b>	Carbon fibre evaporation head including 1m high purity carbon fibre
	<b>PP10999</b>	Film thickness monitor (FTM)
<b>Specimen holders</b>	<b>10245</b>	Top loading specimen shuttle for planchettes
	<b>10246</b>	Top loading specimen shuttle, to take a 10mm stub
	<b>10247</b>	Top loading specimen shuttle for rivets (vice style)
	<b>E7433</b>	Rivet holder specimen stub, screw-down style (for use with 10246)
	<b>E7449-5</b>	Universal specimen stub with surface holes and slots (pack of 5)
	<b>AL200077B</b>	Specimen stub shuttle (spare)
	<b>E7402</b>	Aluminium (Al) stubs (pack of 10)
	<b>E7403</b>	Copper (Cu) stubs (pack of 10)
	<b>E7405</b>	Screw down stub for thin hard specimens
	<b>E7406</b>	Copper (Cu) stubs with 3 x 3mm slots (pack of 5)
	<b>E7407</b>	Copper (Cu) stubs with 1 x 3mm slot (pack of 5)
	<b>32816510</b>	Brass rivets for fracturing liquids (pack of 100)
<b>Sputtering targets</b>	<b>E7400-314A</b>	Gold (Au) target 0.2mm thick
	<b>E7400-314B</b>	Gold/palladium (80:20%) target 0.2mm thick
	<b>E7400-314C</b>	Platinum (Pt) target 0.2mm thick
	<b>E7400-314IR</b>	Iridium (Ir) target 0.3mm thick
	<b>E7400-314CR</b>	Chromium (Cr) target 0.3mm thick

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