Quorum Technologies

Q150T Turbo-Pumped Sputter Coater/Carbon Coater

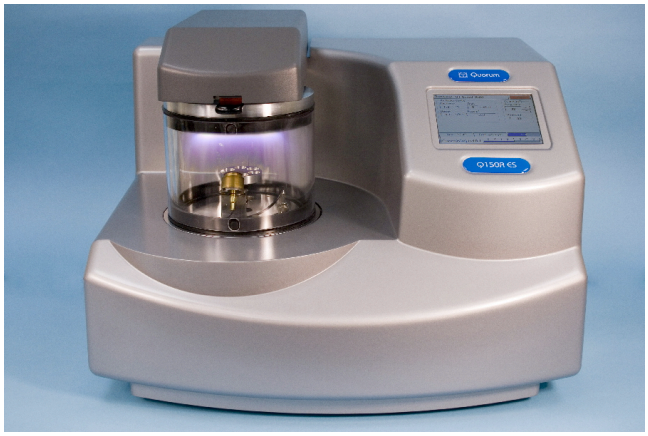
Quick Overview

The Q150T is a compact turbomolecular-pumped coating system suitable for SEM, TEM and many thin film applications. The Q150T replaces previous models K575X and K950X.

If you are looking for a turbo coater with two sputtering heads (for sequential coating of two metals without breaking vacuum), please see the Q300T D.

The Q150T is available in three formats:

- **Q150T S** - a high resolution sputter coater, suitable for oxidising and non-oxidising metals
- **Q150T E** - a high vacuum carbon coater for SEM and TEM applications
- **Q150T ES** - a high resolution sputter ***and*** high vacuum coater



Key features

- **Metal sputtering or carbon evaporation, or both** - can be combined in one space-saving design
- **Fine grain sputtering** for advanced high resolution FE-SEM applications
- **High vacuum turbo pumping** - allows sputtering of a wide range of oxidising and non-oxidising metals - suitable for SEM, high resolution FE-SEM and also for many thin film applications. NB: To avoid a short target life, it is not advisable to use targets of less than 0.3mm for coatings of 50nm or thicker in conjunction with high sputter currents. Please consider using a bonded or thicker target
- **High vacuum carbon coating** - ideal for SEM and TEM carbon coating applications

- **Advanced 'anti-stick' carbon rod evaporation gun -** simple operation, reproducible results
- **Pulsed or ramped carbon coating modes** - ramped evaporation can be selected for enhanced control and reproducibility of deposited carbon
- **Glow discharge option** - for modification of specimen surface properties (eg hydrophobic to hydrophilic conversion)
- **Enhanced sputtering of aluminium using optimised pulse cleaning**
- **Precise thickness control using the film thickness monitor option**
- **Fully automatic touch screen control -** rapid data input, simple operation
- **Multiple, customer-defined coating schedules can be stored** - ideal for multi-user laboratories
- **Automatic vacuum control which can be pre-programmed to suit the process and material** - no needle valve to adjust
- **'Intelligent' recognition of system** - automatically detects the type of coating insert fitted
- **Easy-to-change, drop-in style specimen stages (rotation stage as standard)**
- **Vacuum shut-down feature** - leaves the process chamber under vacuum when not in use - improved vacuum performance
- **Pump hold -** allows the system to be held in continuous pumping mode, awaiting user input before continuing the process
- **Thick film capabilities** - up to 60 minutes sputtering time without breaking vacuum (rest periods automatically built in)
- **Ergonomic one-piece moulded case** - easy maintenance and service access
- **Ethernet with local FTP server connection** - simple programmer updates
- **Power factor correction** - complies with the current legislation (CE Certification) - efficient use of power means reduced running costs
- **Three-year warranty**

Product description

Ideal for SEM, high resolution FE-SEM and TEM applications
The Q150T is available in three formats: sputtering, carbon evaporation or both. Depending upon the selected configuration, the Q150T can be a top-of-the-range sputter coater for high resolution scanning electron microscopy (SEM), a carbon coater suitable for SEM and transmission electron microscopy (TEM), or both - in a single easy-to-use system.

The ability of the Q150T to rapidly sputter a wide selection of oxidising and non-oxidising metals also makes it an ideal platform for many thin film applications.

Moulded case with colour touch screen
The Q150T is presented in a custom moulded, one-piece case - allowing easy servicing access. The colour touch screen allows multiple users to input and store coating 'recipes'.

The case houses all the working components, including the efficient 70L/s air-cooled turbomolecular pump. Automatic bleed control ensures optimum vacuum conditions during sputtering.

The vacuum chamber has an internal diameter of 165mm/6" and comes with an integral implosion guard. The Q150T also includes 'vacuum shutdown', which enhances vacuum performance by allowing the chamber vacuum to be maintained when the system is not in use.

A variable speed rotary specimen stage is fitted as standard, with other stages available as options - see Options and Accessories.

Sputter coating, carbon coating or both
The three different formats of the Q150T each include a range of optional accessories:

***Q150T S** - a high resolution sputter coater for oxidising and non-oxidising (noble) metals. A wide selection of sputtering targets is available, including iridium (Ir) and chromium (Cr) which are highly recommended for FE-SEM applications.
***Q150T E** - a high vacuum carbon coater, ideal for the production of highly stable carbon films and surface replicas for transmission electron microscopy (TEM). The system uses economical, high purity 3.05mm Ø carbon rods.
***Q150T ES** - a combined system with *both* sputtering and carbon coating. The deposition heads can be swapped in seconds and the intelligent system logic automatically recognises which head is in place and displays the appropriate operating settings.

Each of the above can be fitted with a range of optional accessories (metal evaporation, carbon fibre coating, film thickness monitor, etc). See Options and Accessories for details.

Rapid data entry
At the operational heart of the Q150T is a simple colour touch screen which allows even the most inexperienced or occasional operator to rapidly enter and store their own process data. To further aid ease of use, a number of typical sputtering and evaporation profiles are already stored.

Carbon coating - pulsed or ramped evaporation mode (Q150T ES and Q150T E)
Pulsed evaporation is suitable for most SEM carbon coating processes and for applications requiring enhanced control and reproducibly of thickness of deposition, for example for TEM carbon films.

Generally, this process requires the use of the optional extended-height chamber (see 10429). However, the shorter standard chamber may be used for coating thicknesses greater than 12nm. Additionally, if the short chamber is used, the FTM measurement may be inaccurate due to the close proximity of the high temperature carbon rods.

Pulsed cleaning for aluminium sputtering
Aluminium (Al) can be difficult to coat due to its fast oxidising properties. Also, its oxidised layer is difficult to remove because it reduces the required target voltage to produce a sputter current of 150mA. This increases the time required to clean the target.

However, the Q150T ES and Q150T S have special profiles for aluminium (Al) that reduce the oxide removal time and prevent excessive pre-sputtering of the already clean target.

Additional Information

Glow Discharge Attachment

The primary application of glow discharge is as a technique for the surface modification, or 'wetting', of newly-evaporated transmission electron microscopy (TEM) carbon support films.

Hydrophilisation
Freshly-made TEM carbon support films tend to have hydrophobic surfaces which inhibits the spreading of suspensions of particles in negative staining solutions. However, after glow discharge treatment with air, the carbon film is made hydrophilic and negatively charged, thus allowing easy spreading of aqueous suspensions. With subsequent magnesium acetate treatment the surface is made hydrophilic and positively charged.

In addition to glow discharge treatment using air, other process gases may be used to modify surface properties. For example, methanol as a process gas results in the surface becoming hydrophobic and negatively charged. Such treatment can facilitate the optional absorption of selected biomolecules.

Options and Accessories (including details of coating head inserts and specimen stages that are fitted as standard)

Coating head options:
A range of interchangeable, plug-in style coating head inserts are available:

* **Sputtering head insert.** Suitable for oxidising and non-oxidising metals. Supplied with a 54mm Ø x 0.3mm thick chromium (Cr) target as standard. For additional targets see Ordering Information
* **Additional sputter head insert.** Available for quick coating material change (TS and TES versions only)
* **Carbon rod evaporation head insert** (for 3.05mm Ø rods)
* **Carbon rod evaporation head insert** (for 6.15mm Ø rods). NB: we recommend 3.05mm Ø rods as they offer greater process control and are more economical (less wastage)
* **Carbon fibre evaporation head insert**
* **Metal evaporation and aperture cleaning head insert**, including the ability to evaporate upwards or downwards (TE and TES versions only)

Specimen stages:
The Q150T has specimen stages to meet most requirements. All are easy-to-change, drop-in style (no screws) and are height adjustable (except for the rotary planetary stage):

* **Rotation stage**, 50mm Ø (supplied as standard). This stage only rotates - no tilt or height adjustment

* **Rotate-tilt stage**, 50mm Ø with height adjustment (target to stage height variable between 37mm and 60mm). The tilt angle can be pre-set
* **Variable angle 'Rota-cota' rotary planetary stage** with 50mm Ø specimen platform
* **Flat rotation stage for 4"/100mm wafers**
* **Rotation stage for glass microscope slides**

Other options:

* **Extended height chamber** for tall specimens
* **Film Thickness Monitor (FTM)**. The optional 10454 consists of a controller and quartz crystal oscillator built into the Q150T, and a vacuum feed through, chamber-mounted crystal holder and quartz crystal. As sputtered or evaporated material is deposited onto the crystal, so its frequency of oscillation is modified. This 'modification' is used to measure and control the thickness of material deposited
* **Full range vacuum gauge** for low and high vacuum measurement (a low vacuum Pirani gauge is fitted as standard)

Specifications

Instrument case	585mm W x 470mm D x 410mm H (total height with coating head open: 650mm)
Weight	33.4kg
Packed dimensions	725mm W x 660 mm D x 680mm H (42kg)
Work chamber	Borosilicate glass 150mm ID x 127mm H
Safety shield	Integral polyethylene terephthalate (PET) cylinder
Display	145mm x 320mm x 240mm colour graphic thin film transistor (TFT) display
User interface	Intuitive full graphical interface with touch screen buttons, includes features such as a log of the last 10 coatings carried out and reminders for when maintenance is due
Sputter target	Disc style 54mm Ø or 57mm Ø. A 0.3mm thick chromium (Cr) is fitted as standard. Q150T S/T ES versions only
Vacuum	
Turbomolecular pump	Internally-mounted, 70L/s air-cooled turbomolecular pump
Rotary pump	50L/m two-stage rotary pump with oil mist filter (Order separately, see EK3175)
Vacuum measurement	Pirani gauge as standard. A full range gauge (10428) is available as an option
Typical ultimate vacuum	$5x10^{-5}$mbar.
Sputter vacuum range	Between $5x10^{-3}$ and $5x10^{-1}$mbar
Specimen stage	60mm Ø rotation stage. Rotation speed 8-20 RPM For alternative stages see Options and Accessories
Processes	
Sputtering	0-150mA to a pre-determined thickness (with optional FTM) or by the built-in timer. The maximium

	sputtering time is 60 minutes (without 'breaking' vacuum and with built in rest periods)
Carbon evaporation	A robust, ripple free DC power supply featuring pulse evaporation ensures reproducible carbon evaporation from rod or fibre sources. Current pulse: 1-90A
Metal evaporation and aperture cleaning insert (option)	For thermal evaporation of metals from filaments or boats. For cleaning SEM or TEM apertures a standard molybdenum boat (supplied) can be fitted. The metal evaporation head is set up for downwards evaporation, but upward evaporation can be achieved by fitting two terminal extensions (supplied). Evaporation times: up to four minutes

Services and other information

Gases	Argon sputtering process gas, 99.999% (TS and TES versions) Nitrogen venting gas (optional)
Electrical supply	90-250V 50/60Hz 1400VA including rotary pump power. 110/240V voltage selectable
Conformity	CE conformity: Power factor correction. Complies with the current legislation (CE Certification) and ensures efficient use of power, which means reduced running costs

Ordering information

Q150T S	High Resolution Turbomolecular-Pumped Sputter Coater, including a TK8845 54mm Ø x 0.3mm chromium (Cr) target
Q150T E	Turbomolecular-Pumped Carbon Evaporator, suitable for TEM and SEM applications. Fitted with a carbon rod evaporation insert for 3.05mm Ø carbon rods. Supplied with carbon rods (C5422 3.05mm Ø x 100mm) and a carbon rod shaper (manual operation)
Q150T ES	High Resolution Turbomolecular-Pumped Sputter Coater and Carbon Evaporator, including a TK8845 57mm Ø x 0.3mm chromium (Cr) target and high vacuum carbon rod evaporation insert for 3.05mm Ø carbon rods. NB: coating inserts are interchangeable

Rotary pump requirements (needs to be ordered separately)

EK3175	Edwards RV3 50L/s two-stage rotary pump, with vacuum hose, coupling kit and oil mist filter

Options and accessories

10879	Carbon rod evaporation insert for 3.05mm Ø rods (T E and T ES only). Includes S8651 manual rod shaper and C5422 (3.05mm Ø X 300mm packet of ten) carbon rods
10455	Carbon fibre insert, supplied with 1m A0819 high purity carbon fibre cord and 1m of C5421 standard grade carbon fibre cord. NB: For additional supplies see Carbon supplies

10457	Metal evaporation and aperture insert, including the ability to evaporate upwards or downwards (TE and TES version only). Supplied with a pack of 10 tungsten filaments (A0754) and a molybdenum (Mo) boat
10453	Additional sputter insert for quick metal change (TE and TES version only). NB: this is an entire sputtering assembly; individual targets can also be purchased
10837	Glow discharge insert. Used to modify surface properties (eg hydrophobic to hydrophilic conversion) (R S and R ES versions only). Can be retrofitted
10360	Variable angle 'Rota-cota' rotary planetary specimen stage with 50mm Ø specimen platform with six stub positions for 15mm or 6.5mm or 1/8" pin stubs. Stage rotation speed variable between 8-20 RPM
10357	Variable tilt angle specimen stage with adjustable tilt up to 90°. 50mm Ø specimen platform with six stub positions for 15mm or 6.5mm or 1/8" pin stubs. Stage rotation speed variable between 8-20 RPM
10458	Flat rotation specimen stage for 4"/100mm wafers, includes gear box for increased coating area coverage. Stage rotation speed variable between 8-20 RPM
10358	Specimen stage for glass microscope slides (up to two x 75mm x 25mm slides). Stage rotation speed variable between 8-20 RPM. Includes gear box to allow optional FTM to be used
10454	Film thickness monitor (FTM) attachment. Including oscillator, feed-through, quartz crystal holder and quartz crystals
FT553	Spare quartz crystals. Pack of three
10428	Full range gauge for high vacuum measurement (factory fitted)
10429	Extended height vacuum chamber (214mm in height - the standard chamber is 127mm high). For increased source to specimen distance and for coating large specimens
10422	Vacuum spigot allows more convenient connection of the vacuum hose to the rear of the Q150T when bench depth is limited

Sputtering Targets NB: The Q150T S and Q150T ES are fitted as standard with a 0.3mm thick chromium (Cr) target (TK8845)

TK8875	Aluminium (Al) 57mm Ø x 1.0mm
TK9000	Aluminium (Al) 57mm Ø x 0.76mm
TK8869	Carbon (C) 54mm Ø x 1.5mm
TK8845	Chromium (Cr) 54mm Ø x 0.3mm
TK8862	Chromium (Cr) 54mm Ø x 1.5mm
TK8900	Cobalt (Co) 57mm Ø x 0.1mm
TK8870	Copper (Cu) 57mm Ø x 0.1mm
TK8889	Gold (Au) 57mm Ø x 0.3mm
TK8859	Gold (Au) 57mm Ø x 0.1mm
TK8860	Gold/palladium (Au/Pd) 57mm Ø x 0.1mm
TK8891	Gold/palladium (Au/Pd) (60:40) 57mm Ø x 0.3mm
TK8907	Indium tin oxide (ITO) 57mm Ø x 0.3mm
TK8899	Iridium (Ir) 57mm Ø x 0.2mm
TK8897	Iron (Fe) 57mm Ø x 0.1mm
TK8905	Magnesium (Mg) 57mm Ø x 0.3mm
TK8903	Molybdenum (Mo) 57mm Ø x 0.1mm

TK8872	Nickel (Ni) 57mm Ø x 0.1mm
TK8877	Palladium (Pd) 57mm Ø x 0.1mm
TK8861	Platinum (Pt) 57mm Ø x 0.1mm
TK8893	Platinum (Pt) 57mm Ø x 0.3mm
TK8878	Platinum/palladium (Pt/Pd) (80:20) 57mm Ø x 0.1mm
TK8887	Platinum/palladium (Pt/Pd) (80:20) 57mm Ø x 0.3mm
TK8871	Silver (Ag) 57mm Ø x 0.1mm
TK8906	Tantalum (Ta) 57mm Ø x 0.1mm
TK8902	Tin (Sn) 57mm Ø x 0.1mm
TK8879	Titanium (Ti) 57mm Ø x 1.5mm
TK8895	Titanium (Ti) 57mm Ø x 0.5mm
TK8846	Tungsten (W) 57mm Ø x 0.5mm
TK8867	Tungsten (W) 57mm Ø x 0.2mm

Carbon supplies

A0819	Carbon fibre cord - high purity - 1m
A0819-5	Carbon fibre cord - high purity - 5m
A0830A	Carbon rods - 6.15mm Ø x 100mm length (unshaped) - pack of 10
A0832A	Carbon rods - 6.15mm Ø x 50mm length (shaped) - pack of 10
A0834A	Carbon rods 3.05 Ø x 50mm, (shaped) - pack of 10
C5421	Carbon fibre cord - standard grade - 1m
C5421-10	Carbon fibre cord - standard grade - 10m
C5421-100	Carbon fibre cord - standard grade - 100m
C5422	Carbon rods 3.05 Ø x 100mm, (unshaped) - pack of 10
C5461	Carbon fibre - fine strands - 1m
C5461-10	Carbon fibre - fine strands - 10m
C5461-100	Carbon fibre - fine strands - 100m
S8650	Manual carbon rod shaper for 6.15mm carbon rods
S8651	Manual carbon rod shaper for 3.05mm carbon rods

Other consumables and spare parts

SEM	BASIC-1 Starter kit - specimen stubs, boxes, mounting media, tweezers etc. NB: state the type of specimen stub required when ordering
A0754	Metal evaporation basket - pack of 10 (for use with 10457 metal evaporation insert)
B5228	Molybdenum Boats - pack of 10
G6260	Glass Cylinder 6"
O7802	Supergrade 'A' Rotary Pump Oil - 1L
O7803	Oil Mist Filter
10447	Two-year spares kit for Q150T S
10448	Two-year spares kit for Q150T E
10449	Two-year spares kit for Q150T ES
16030015	10A ceramic fuse
10194	L gasket (one) to suit