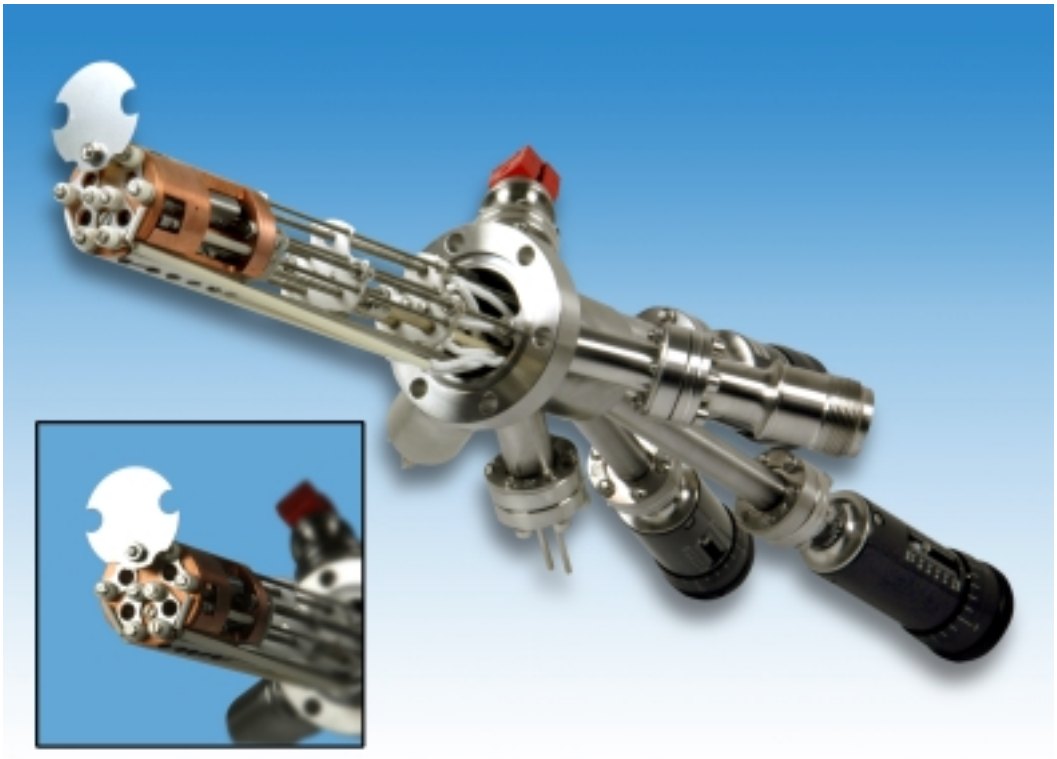
4-pocket Electron Beam Evaporator

E-Beam Evaporator



e⁻-flux4 multi-pocket e-beam evaporator with shutter and individual flux monitor

The new tectra 4-pocket **e⁻-flux4** Mini E-Beam Evaporator extends the range of single pocket evaporators which have been successfully built since 1997. Like the single pocket version (e⁻-flux) the **e⁻-flux4** is an UHV evaporator for highest purity thin films. Co-evaporation of small and medium quantities of almost any material in the temperature range of 400K to >3100K is possible. Highly controllable deposition rates allow thin films from sub-monolayer up to multi nanometer.

Main Features:

- co-evaporation of 4 materials out of a single CF35 (2.75") port
- highest flexibility of rod and crucible evaporation
- highly controllable by individual flux measurement or thermocouple control
- entirely separated, water-cooled evaporation zones to minimise cross contamination

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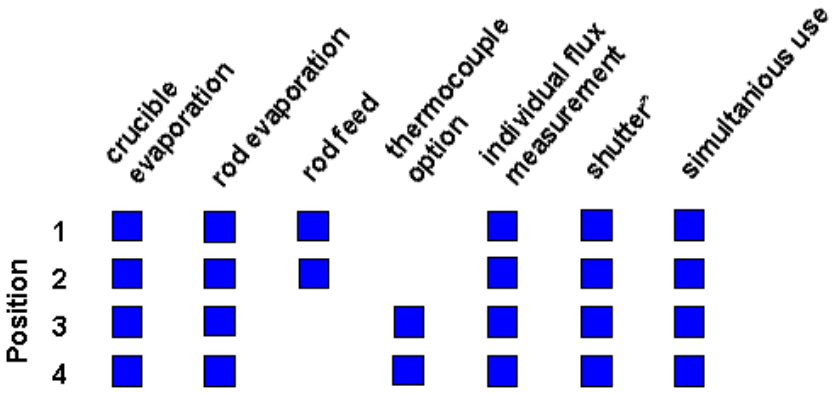
The **e⁻-flux4** construction allows simultanious evaporation out of 4 pockets. For maximum flexibility different configurations of evaporant rods or crucibles, flux measurement and shutter are possible and shown in the enclosed chart. Two of the positions have a linear drive for feeding the evaporant rod for long evaporation without need to vent the system. The two other positions can be equipped with crucibles (or rods with short length of evaporation). These positions can optionally have thermocouple control. All four positions can have individual flux control via ion current monitoring and can be used simultaniously (standard power supply configuration).



* 6 out of 16 configurations of shutter positions possible

Principle of operation:

A filament surrounding the evaporant rod or crucible is run at high current of ca. 4-5A to emit electrons. A positive high voltage (1-3 kV) is applied to the evaporant rod or crucible attracting the electrons of the filament. Due to the very high electron density on the tip of the rod or to the crucible temperatures of >3.100K can be achieved. By controlling the filament current one can alter the temperature and accordingly the evaporation rate such that a wide range of film thickness from sub-monolayer to multi nanometers can be produced.

The **e⁻-flux4** being a multi pocket evaporator allows co-evaporation of 4 materials out of a single NW35CF (2.75"OD) port and with a single power supply. Each filament is independently regulated and controllable by an individual flux monitor (optional).

The flux monitor is the most commonly used option and works on the basis of ion current measurement. By electron bombardment of the evaporant a certain fraction of the vapour will be ionised. The flux electrode is biased and collects the ions as a means of evaporant flux. This information can serve in a feedback loop to control the power supply.

An optionally shutter can be equipped allowing several configurations of open and closed evaporation positions.

Satisfactory operation also means easy and cost effective self-servicing. For utmost uptime e.g. the filaments are easily replaced and user fabricated from standard Tungsten wire at near zero running costs. At a high level only standard components are used to mostly enable on-site trouble shooting. All feedthroughs are user demountable. As an example, the rod feed is done by a commonly available linear motion feedthrough (L-2111-1 from Huntington).

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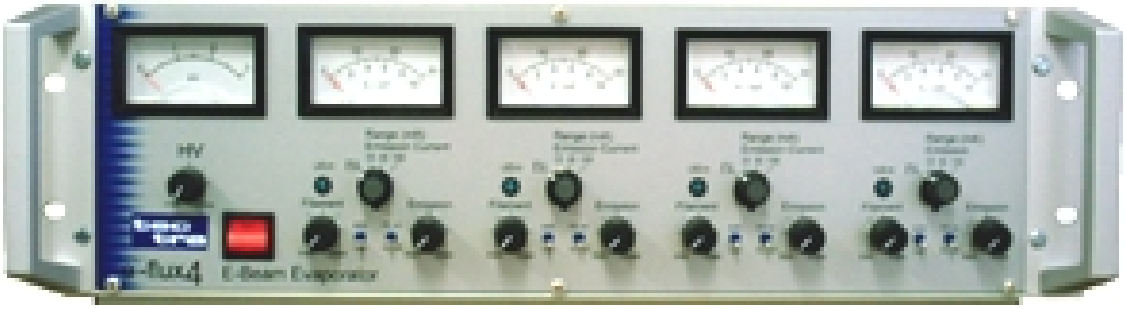
Applications:

As Mini E-Beam Evaporator the main application is in material science where highly uniform thin films of smaller spot sizes are desired, e.g. in surface science, thin films preparation and doping. Besides commonly used materials with moderate melting points even highest temperatures can be achieved to evaporate materials such as Molybdenum, Tantalum, Titanium or Graphite.

The versatile constructions allows the evaporation interchangeably from rod (Ø2mm wire) or out of crucibles. Evaporation from rod is generally preferable as this produces the highest purity films, avoids eventual conflicts with crucible alloying and can be used from any direction (even downwards). However, some materials can only be evaporated out of crucibles due to low melting point or too high thermal conductivity. Furthermore, insulators and oxides can only be evaporated out of crucibles. In these cases a wide selection of crucible materials such as Molybdenum, Tantalum, Tungsten and Graphite is available. Further, a ceramic crucible liner (generally Boron Nitride) can be used. In some cases a so called 'wetted wire technique' can be used. An example is Platinum evaporation where a thin Pt wire is wound around a W rod. In a first step the Pt is molten by the heat of the filament and 'wets' the W rod. In the second step the e-beam evaporation of the Pt film can take place where the W rod only serves as 'backbone' to keep the evaporant straight.

Examples:

Material	**Evaporation mode**
Gold	Ta crucible
Chromium	Rod
Copper	Ta crucible
Aluminium	Mo crucible with BN liner
Carbon	Rod
Platinum	wetted wire technique
Silicon	Ta crucible (or rod when doped Si)
Molybdenum	Rod
Nickel	C crucible
Iron	Rod
Tungsten	Rod



e-flux4 power supply for simultanious evaporation of 4 materials

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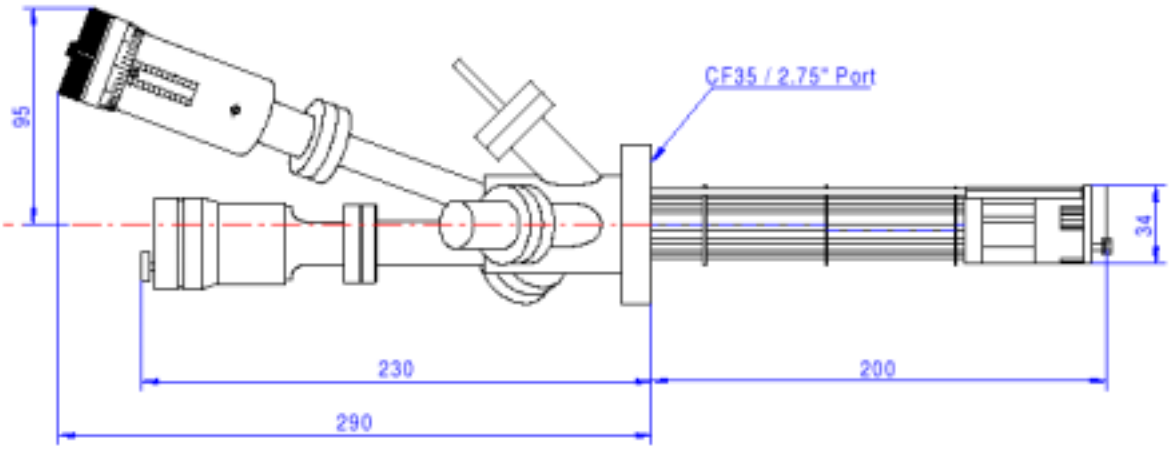
e-flux4

Specifications:

In vacuum length:	190mm (without options)
Max in vacuum diameter:	34mm
Mounting flange:	CF35 (2.75"OD)
Bakeout temperature:	Max. 200°C
Rod feed:	25mm on 2 evaporant positions
Crucible volume:	0,3ccm
Crucible materials	Mo, Ta, W, pyrol. Graphite, BN liner, Al_2O_3, Quartz
Deposition rate:	from <0,01A/s to >2nm/s
Beam divergence:	±15°
e-beam power:	max 300W
Controller:	19" rack mount, 3U high for power supply. An extra 19" case necessary for control pack (flux monitor, temperature control)230VAC/50Hz or 115VAC/60Hz or 100VAC/50Hz
Options:	shutter, flux monitor/deposition controller (see below), thermocouple, various crucibles (see above), motorised rod feed and others



e-flux4 ebeam evaporator dimensions

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e^--flux with optional Depostion Controller

Deposition Controller: for many years the flux measurement of the e--flux Mini E-Beam Evaporator has been established to indicate the deposition growth rate. Besides flux monitoring a PID control was available to keep the flux/rate constant.

As a new option a Deposition Controller is offered. This extends the flux based possibilities by features as known from quartz microbalances.
The Deposition Controller is an ideal tool for users who often want to evaporate different thickness or evaporation rates from known material. Parameters of up to 9 materials and processes can be stored after an initial calibration. A user friendly software is provided. Via an RS232C interface the process can be controlled and monitored.

The Deposition Controller needs the flux electrode option.

- reproducible evaporation
- stores up to 9 materials/process parameters
- RS232C interface for control and documentation

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