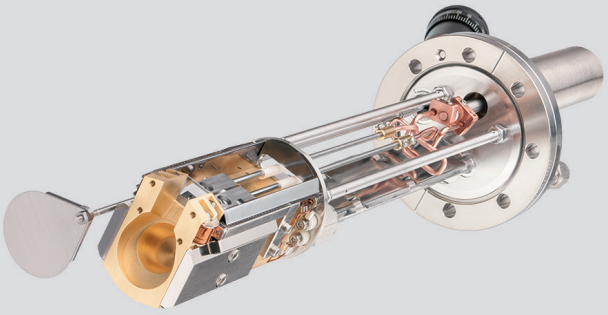
MBE
KOMPONENTEN | DR. EBERL

# VERTICAL E-BEAM EVAPORATOR EBVV

- UHV compatible, low outgassing
- High purity evaporation
- Hearth volumes 4 $cm^3$ or 5 $cm^3$
- Long filament lifetime
- High frequency x-y-beam deflection
- Optimized version for SiGe MBE with silicon shielding parts



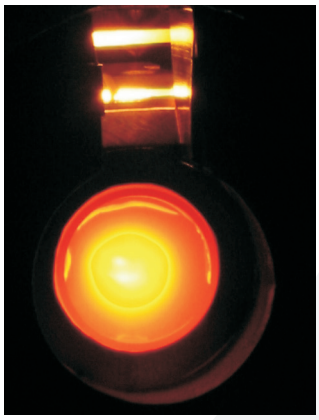
EBVV 63-T4-S on DN63CF (O.D. 4.5") flange

Vertical Electron Beam Evaporators EBVV allow introducing real e-beam evaporation into many growth systems originally designed for radiation heated effusion cells only.
Despite its small footprint, the EBVV features a complete electromagnetic x- and y-dynamic beam deflection system and is capable of delivering beam powers up to 3 kW.

The unique and extremely compact design makes it possible to install the EBVV instead of an ordinary effusion cell on any MBE system having a DN63CF (O.D. 4.5") port with I.D. ≥ 60mm.
Inclined ports can be used without any difficulty for sublimating crucible charges. For materials that become liquid during operation EBVV evaporators are available with a tilted hearth geometry (tilt angle 25°). Ports with an inclination of max. 58° can thus be used.
Two different hearth volumes are available: the 4 $cm^3$ geometry is compatible with standard crucible liners, while the 5 $cm^3$ model is recommended for Si epitaxy (in combination with specially adapted silicon shielding parts).

Especially for all hot parts only UHV-grade materials are used without any compromise: molybdenum emitter block, tungsten filament and $Al_2O_3$ insulating ceramics. The main body is manufactured from OFHC (oxygen-free high thermal conductivity) copper. For highly effective cooling the copper hearth is closely surrounded by a complete turn of an Ω-shaped water channel.

For Si growth in an MBE system a specially designed set of shielding parts manufactured from high purity single-crystalline silicon is available for the EBVV 63-5.
All parts of the metallic body that face the substrate and are potentially subject to electron or ion bombardment are covered by a Si plate and ring. This Si-shielding is a qualification for the growth of highest purity Si-based films with virtually no metallic contamination. The set is complemented by a high purity Si charge (source material in superior quality machined from wafer-grade Si single crystals) that fits the hearth closely. .



Look onto an EBVV evaporator with tilted hearth and additional Ta shielding parts (right hand under operation)

For metal deposition the EBVV 63-4 can be used with bare copper hearth for all metals that do not melt completely (e.g., Al) or that do not react with the cooled copper wall. Crucible liners manufactured from graphite or refractory metals are available for all other materials. Please inquire about a solution for your particular evaporant.

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## Applications

The EBVV closes the gap between small rod-fed e-guns, that usually provide very low fluxes and are only suitable for sublimating materials, and common horizontally mounted e-beam evaporators, which often are excessively space consuming and far overrated for many MBE applications.
Furthermore, EBVV evaporators are a good alternative for radiation heated high temperature effusion cells, providing an insufficient flux at their maximum temperatures.
The EBVV is the ideal evaporator for any low vapor pressure material, including refractory metals or dopants like, e.g., boron or carbon. It can also serve the upcoming demands in newly developed material systems like high-k materials ($Al_2O_3$ or $Pr_2O_3$) or other oxides and dielectrics.

## Technical Data

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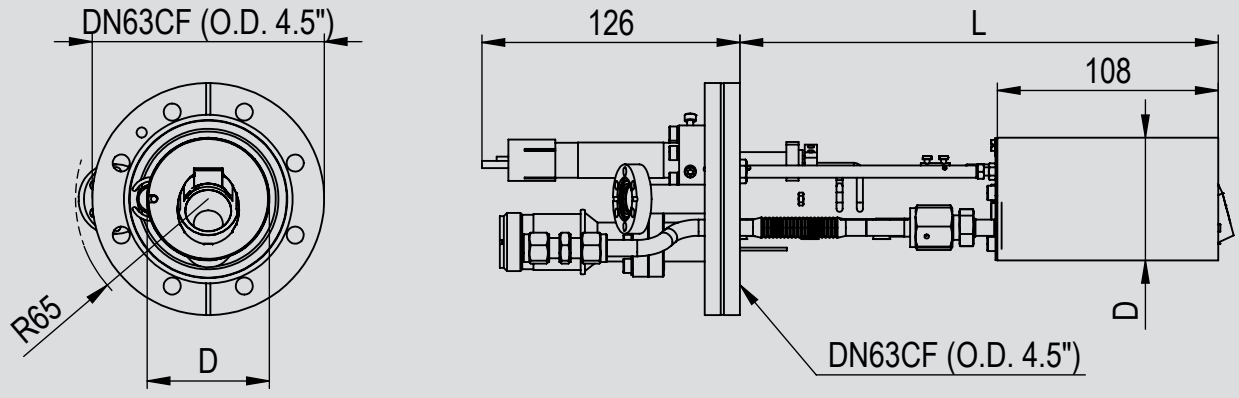
|---|---|
| Mounting flange | DN63CF (O.D.4,5") or DN100CF (O.D.6") |
| Dimensions in vacuum | L= 220-400 mm; D= 60 mm |
| Hearth capacities | 4 $cm^3$ (EBVV 63-4, EBVV 100-4) or 5 $cm^3$ (EBVV 63-5, EBVV 100-5) |
| Hearth dimensions | H=15 mm; Ø=22 mm (15° taper) or Ø=23 mm (12° taper) |
| Filament type | short-legged coil of W wire, electron emitting filament |
| Bakeout temperature | max. 200°C (all air side connectors removed) |
| Acceleration voltage | 4 - 6 kV |
| Beam power | max. 3 kW |
| Filament current | max. 25 A at 10 V (AC) |
| Spot size | 5 mm diameter, approximately |
| Primary beam deflection | 270° by permanent magnet system |
| Dynamic beam deflection | KAPTONTM-isolated wire coils; deflection frequency: max. 150 Hz |
| Max. deflection currents | x-deflection current: ± 2 A; y-deflection current: ± 2 A |
| Water cooling | min. water flow rate 5 l/min at 4 bar |
| Options | tilted hearth (T); integrated rotary shutter (S) |




Schematic drawing of the Vertical Electron Beam Evaporator EBVV
(Drawing shows EBVV 63-4 (5))

The DN100CF version only differs in the mounting flange dimension.

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