

TUBO Effusion Sources\*

Instead of a wire filament, the **TUBO** source uses a tubular filament that encloses the entire crucible. The heating current flows along the source axis, up through the heat insulation shields and down through the filament. The crucible temperature is controlled via a thermocouple at the bottom of the crucible. This concept enables a reproducible temperature control of a standard effusion source at a high temperature range so far only accessible with e-beam evaporation. For extremely high temperatures, the **TUBO-e** includes an electron emission booster heater.

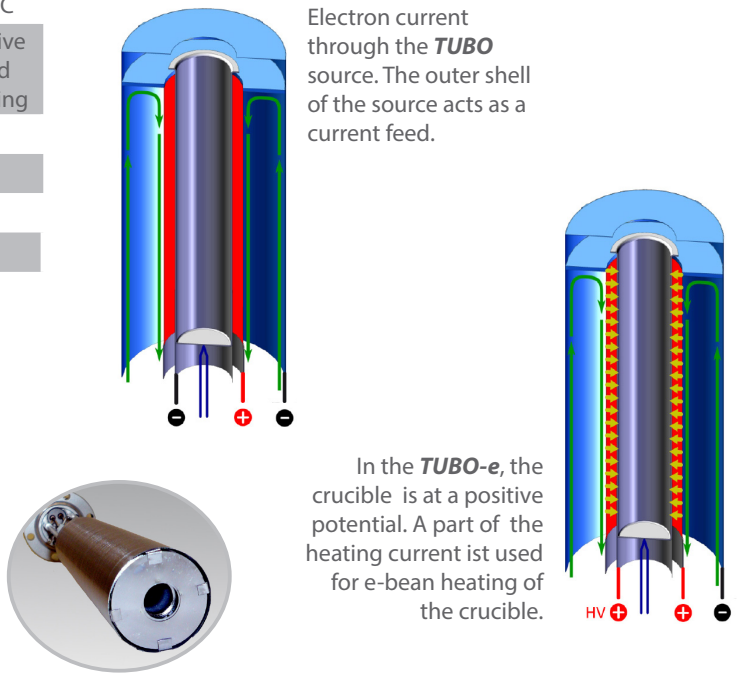
C	B	Si	Sc	Ti	V	Cr	Fe	Co	Ni	Cu	Ge	Y	Rh	Pd	Cd	La	Ce	Pr	Nd	Gd	Tb	Dy	Lu	Pt	Au
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TYPE	TUBO	TUBO -e
TEMPERATURE RANGE	200 - 2100 °C	200 - 2400 °C
HEATING SYSTEM	Resistive cylinder heating	Hybrid resistive cylinder and e-beam heating
TEMPERATURE STABILITY	0.1 °C	
MAX. OUTGAS. TEMPERATURE	2100 °C	2400 °C
FLANGE SIZE	DN 40 CF   63   100	
MAX. POWER	1100 W	1700 W

Options

- Integrated shutter
- Water cooling
- Crucible inserts
- Face down version

\* Technology patent-registered. Developed in collaboration with Paul-Drude-Institut, Berlin.



High Temperature Cell (HTC)

The conventional High Temperature Cell is designed to evaporate materials with low vapor pressure at temperatures up to 2000 °C. The hot area of the effusion cell is made entirely from tantalum and tungsten. The cell is characterized by its stability and durability.

B	C	Si	Sc	Ti	V	Cr	Fe	Co	Ni	Cu	Ge	Y
Rh	Pd	Cd	La	Ce	Pr	Nd	Gd	Tb	Dy	Lu	Pt	Au

TYPE	HTC 1700   2000
TEMPERATURE RANGE	100 - 1700 °C   100 - 2000 °C
HEATING SYSTEM	Radiation heating, self-supported wire filament
TEMPERATURE STABILITY	≤ 0.1 °C
MAX. OUTGAS. TEMP.	2100 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	450 W



EVAPORATORS

Additional equipment for Evaporators

Water Cooling Systems

CreaTec offers custom designed water cooling systems for evaporators and MBE systems.

TYPE	WK
MATERIAL	Stainless steel
COOLING MEDIUM	Water   alcohol   2 - 5 l/min   1 - 2 bar
FLANGE SIZE	DN 40 CF   63   100
DESIGN AND GEOMETRY	as specified
WATER CONNECTION	Standard tube 6 x 1 or as specified

Effusion Cell Shutters

Typical shutters for effusion cells are designed with two stacked shutter blades - one is directed towards the orifice of the cell and the other one towards the sample. The downward looking blade can be easily exchanged. Shutter size and dimensions vary depending on the application.

TYPE	SH
WORKING PRINCIPLE	Rotary shutter (others on request)
FLANGE SIZE	DN 16 CF   40   63
BLADE MATERIAL	Molybdenum, Tantalum, PBN or PGR
ROD MATERIAL	Molybdenum
DESIGN AND GEOMETRY	as specified
ACTUATOR	Manual (SH-M), pneumatical (SH-P) or electrical (SH-E)

Crucibles



Crucibles are available for all common MBE systems and effusion cells in a large variety of **sizes** and **materials**:

- Tantalum (Ta)
- Molybdenum (Mo)
- Pyrolytic boron nitride (PBN)
- Beryllium oxide (BeO)
- Quartz (SiOx)
- Tungsten (W)
- Pure graphite (Gr)
- Pyrolytic graphite (PGr)
- Vitreous carbon (VC)
- Aluminum oxide (Al<sub>2</sub>O<sub>3</sub>)
- Yttrium oxide (Y<sub>2</sub>O<sub>3</sub>)
- Iridium (Ir)
- High temp. stainless steel

► Visit [www.createc.de](http://www.createc.de) for more information and a complete overview of our products, e.g. linear effusion cells, gas sources and multi cells.



Evaporators

CreaTec offers a wide range of evaporating components

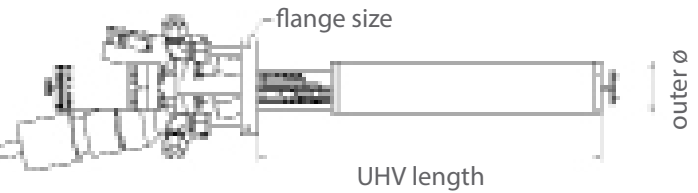


General Information

CreaTec Evaporators are used in ultra-high vacuum (UHV) evaporation systems to generate ultrapure molecular and atomic beams from a large variety of elements and compounds. The different types of evaporators are manufactured to evaporate almost every material. **Operating temperatures can range from: -80 °C to 2400 °C.**

Our principle is your success

Our effusion cells are assembled under Class 10 cleanroom conditions. The consequent use of ultrapure materials as well as the rigorous cleaning and outgassing of all parts are self-evident during our manufacturing process. Helium leak testing and maximum heating temperatures are performed in an UHV environment.



Our custom design is your flexibility

- We design and develop cells in close collaboration with the customers
- Our effusion cells are compatible with MBE systems from all worldwide suppliers
- Integrated shutters and water cooling systems are optional
- High precision controllers and power supplies are available
- Facedown versions can be realized for almost every type of effusion cell



\* Some elements/compounds to be evaporated may require special crucible materials



## Electron Beam Evaporator (EBE)

The CreaTec Electron Beam Evaporator is designed for evaporation of low vapor pressure materials - either from wire, rod or crucible - under true UHV conditions. A high precision control unit is used for the instantaneous variation of all necessary parameters. The **EBE-C version is used for carbon doping** in MBE applications. A pyrolytic graphite rod is heated by electron bombardment to a maximum temperature to evaporate elemental carbon of highest purity. The design prevents any ionized species leaving the source.

Si	Fe	Co	Ni	Cu	Zr	Nb	Mo	Ru	Rh	Pd	Pr	Tb	Ho	Hf	Ta	W	Re	Os	Ir	Pt	Au	Ti	MgF <sub>2</sub>	CaF <sub>2</sub>	MgO
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TYPE	EBE-ST	EBE-C	EBE-AX	EBE-L
TEMPERATURE RANGE	up to 2700 °C	200 - 2200 °C	up to 2700 °C	up to 2700 °C
HEATING SYSTEM	E-beam heating bombardment; self-supported wire filament	E-beam heating bombardment; self-supported wire filament	E-beam bombardment; wire filament	E-beam bombardment; wire filament
EVAPORATION FROM	rod or 0,8 cc crucible	pyrolytic graphite rod	4/5 cc crucible	7/15 cc crucible
MAX. VOLTAGE TARGET	1 kV	1,5 kV	8 kV	10kV
MAX. POWER	0,3 kW	1,7 kW	4 kW	6kW
FLANGE SIZE	DN 40 CF   63 or specified	DN 40 CF   63 or specified	DN 40 CF 63   100 or specified	DN 160 CF   200

### Options

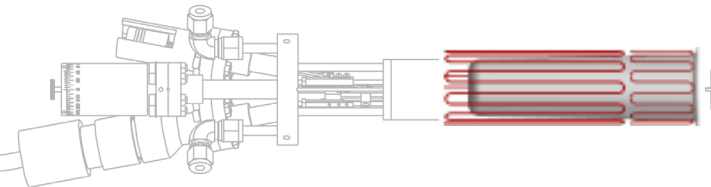
- Different conductive crucible and rod materials
- RS-232 interface for software control
- Shutter upgrade
- Spare filament
- Special retract-unit for differential pumping



**Special design for controlled evaporation of extremely low vapor pressure materials**

## Dual Filament Cell (DFC)

The Dual Filament Cell evaporates materials such as gallium, indium and copper. To prevent material condensation, an additional heating unit with an extra thermocouple is installed near the orifice. This allows independent adjustmet of the orifice temperature and the main temperature of the effusion cell.

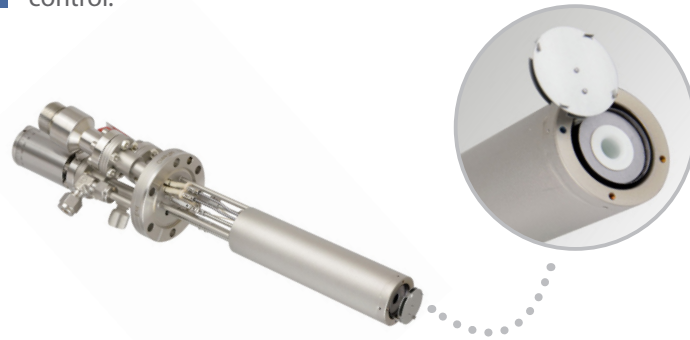


Sc	Ti	Mn	Cu	Ga	Ge	Se	In	Sn	Te	Nd	Sm	Gd
Dy	Er	Tl	Pb	Compounds for CIGS								

TYPE	DFC
TEMPERATURE RANGE	200 – 1400 °C bulk zone 200 – 1400 °C hot-lip
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,2 °C
MAX. OUTGAS. TEMP.	1500 °C bulk zone 1500 °C hot-lip
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	480 W

## Single Filament Cell (SFC)

The Single Filament Cell is designed for evaporation of materials such as germanium, tin, gold and silicon. The heating system is surrounded by a shielding to minimize heat radiation. Direct heat transfer from the filament to the crucible reduces the power consumption and gives an excellent flux control.

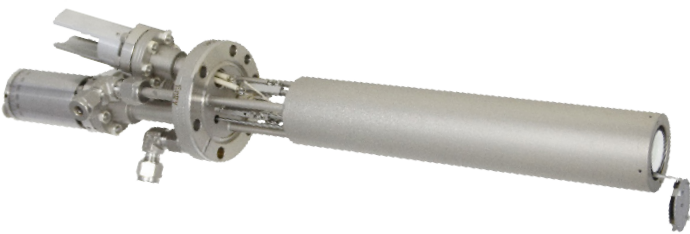


Be	Si	Cu	Ga	Ge	Ag	In	Ba	Nd	Sn	Gd	Dy	Er
Tm	Au	Bi	Compounds for CIGS									

TYPE	SFC
TEMPERATURE RANGE	50 –1400 °C
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS. TEMP.	1500 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	360 W

## Cold Lip Cell (CLC)

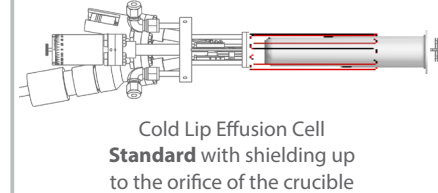
The Cold Lip Cell is designed to evaporate aluminium, which tend to creep out of the crucible due to the wet of the crucible surface. The cold orifice results in a long cell lifetime and a low defect concentration in the epitaxial layers.



Al
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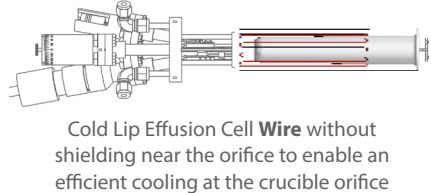
TYPE	CLC
TEMPERATURE RANGE	200 –1400 °C
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS. TEMP.	1400 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	220 W

### CLC-ST



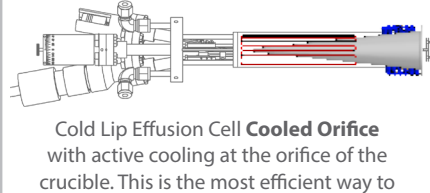
Cold Lip Effusion Cell **Standard** with shielding up to the orifice of the crucible

### CLC-W



Cold Lip Effusion Cell **Wire** without shielding near the orifice to enable an efficient cooling at the crucible orifice

### CLC-CO



Cold Lip Effusion Cell **Cooled Orifice** with active cooling at the orifice of the crucible. This is the most efficient way to cool this area of the cell

## Cracker Cell (CRC)

The Cracker Cell integrates evaporation and cracking of materials that are typically evaporated as molecules. A special heating system is attached to the top of the cell for much higher temperatures than the evaporation temperature. Special insulation parts are used to minimize crosstalk between the two heating stages.



S	As	Se	Sb	Te
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TYPE	CRC
TEMPERATURE RANGE	100 – 1000 °C bulk zone 100 – 1200 °C cracker
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS. TEMP.	1500 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	400 W

## Valved Cracker Cell (V-CRC)

The Valved Cracker Cell combines evaporation and cracking of elements such as arsenic, selenium and tellurium. This cell has an integrated valve to reproducibly control and rapidly change the beam flux by more than two orders of magnitude. The valve is located at the orifice and is heated to prevent any condensation of material.

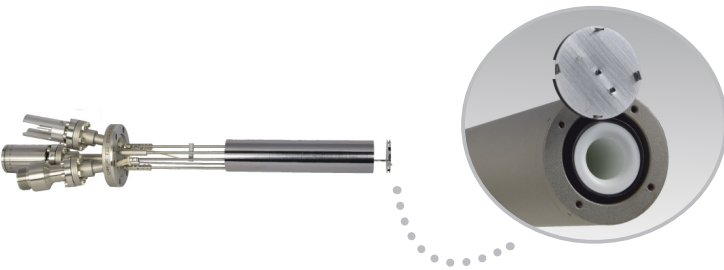


Na	Mg	K	Ca	Zn	As	Se	Sr	Cd	Sb	Te	Ba
Pb	Bi										

TYPE	V-CRC
TEMPERATURE RANGE	100 – 1000 °C bulk zone 100 – 1200 °C cracker
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS. TEMP.	1500 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	400 W

## Low Temperature Cell (LTC)

The Low Temperature Cell evaporates materials with a high vapor pressure such as arsenic, antimony, selenium and zink. Crucibles with large capacity allow long lasting operation. A special heating system design enables a high stability of the molecular beam flux.

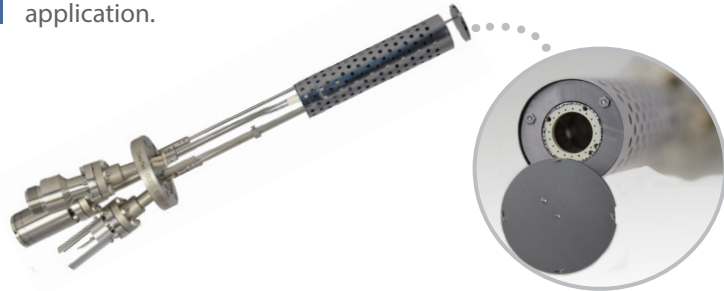


Li	Na	Mg	S	K	Ca	Mn	Zn	As	Se	Rb	Sr
Cd	Sn	Sb	Ba	Eu	Yb	Tl	Pb	Bi			

TYPE	LTC
TEMPERATURE RANGE	50 – 1200 °C
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS TEMP.	1500 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	220 W

## OLED Effusion Cell

The OLED Effusion Cell is designed to evaporate organic materials. The heating element with double windings at the orifice avoids recondensation of material. The integrated water cooling design is optimized for an exact temperature control from ambient temperature up to 800 °C. A multi cell version with up to four effusion cells integrated on one flange enables complex processes with a compact application.

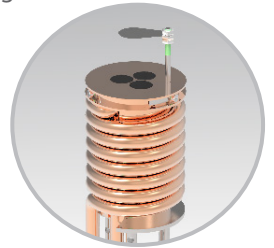


Alq <sub>3</sub>	P, HT	PCBM
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TYPE	OLED
TEMPERATURE RANGE	30 – 800 °C
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS. TEMP.	1500 °C
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	160 W

## Ultra Low Temperature Cell (ULTC)

The Ultra Low Temperature Cell evaporates various materials in a very low temperature range. The crucible is surrounded by a cooling coil to reach ultra low temperatures and a heating element to control the flux of the condensated material. The coil is cooled by dry nitrogen.



I	Cs	Hg	Special OLED compounds
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TYPE	ULTC
TEMPERATURE RANGE	-80 – 30 °C
HEATING SYSTEM	Wire filament, radiation heating
TEMPERATURE STABILITY	≤ 0,1 °C
MAX. OUTGAS. TEMP.	250 °C
COOLING SYSTEM	Copper coil
COOLING MEDIUM	Dry nitrogen
FLANGE SIZE	DN 40 CF   63   100   160
MAX. POWER	50 W

## Power Supplies

These control units are designed to heat effusion cells or to be used with any other application. Each power source is controlled by a precision PID controller from Eurotherm. Load voltage and current are displayed, as well as power and resistance. The power cord to the heater is bakeable up to 200 °C.

### Options

- Adapted power range
- Additional temperature display
- Interface: RS232, RS485, TCP/IP or Profibus
- Interlock
- Shutter Control with EPS
- Voltage/Current monitor via Ethernet

