

VALVED THERMAL CRACKER CELL VTCC

- All-PBN valved solution for corrosive materials like As, Se, Te, Sb, Zn or Mg
- DN40CF (O.D. 2.75") mounting flange compatible with all MBE systems
- Water-cooled cracker working up to 1300°C
- 130 cm³ PBN crucible
- Excellent thermal isolation between low temperature reservoir and hot cracker zone
- Integrated rotary shutter



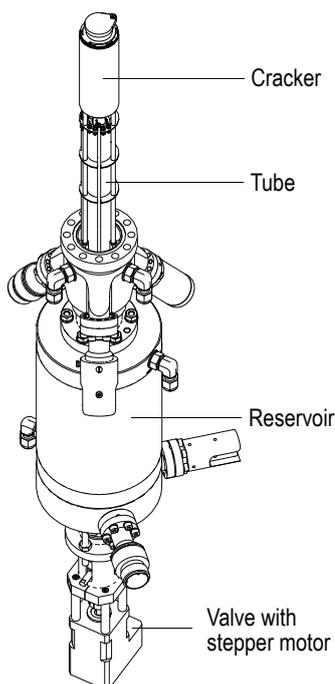
VTCC 40 130-54-KS on DN40CF (O.D. 2.75") flange

The Valved Thermal Cracker Cell VTCC is an all-PBN valved cell with a water-cooled cracker stage. The compact design of the cell allows its implementation on the space-saving DN40CF (O.D. 2.75") mounting flange.

It features a crucible size of 130 cm³ which is sufficiently sized for most R&D applications.

The reservoir heater of the VTCC is designed to perform fast and precise ramps in the temperature range from 100°C to 650°C.

Three independent heating zones for reservoir, valve and cracker allow flexible adjustment of the cell operating conditions.



VTCC zones

This wide variability of parameters, in combination with the all-PBN construction of valve, reservoir and cracker, enables a wide variety of applications with diverse high vapor pressure evaporation materials.

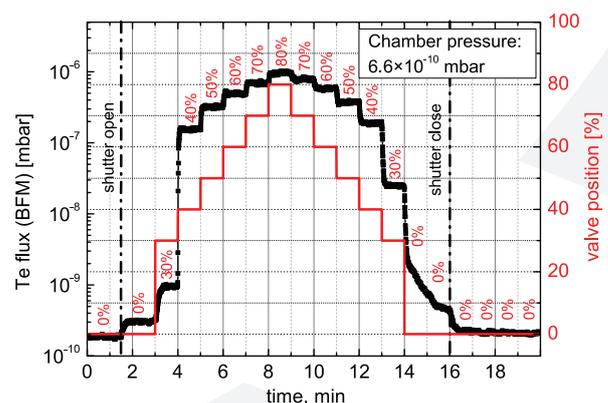
Crucible and cracker zones are surrounded by water cooling shrouds that minimize the thermal load on the chamber.

Valve operation

The figure of VTCC characteristics below shows an example of valve calibration performed with Te. The valve features a wide dynamic range, that allows a precise flux control in the % range of the maximum material flux.

Closing the valve reduces the flux by a factor of about 5000. The VTCC can be equipped with an optional integrated shutter that may be used to reduce the material flux even further.

An excellent thermal insulation between the low temperature reservoir and the hot cracking stage is an outstanding and essential quality of the VTCC.



VTCC characteristics: valve position versus Te flux over time

Applications

The Valved Thermal Cracker Cell VTCC is designed for evaporation of cluster forming high vapor pressure materials, like As, Se, Te, Sb, Zn or Mg at operation temperatures from 100°C to 650°C with an additional cracking stage that reaches temperatures up to 1300°C. The cell concept combines stability and easy operation of a low-temperature effusion cell with the ability to crack larger atomic clusters or longer chains that are frequently formed by the evaporation of high vapor pressure materials from common effusion cells. The cracking effect can be used to raise the reactivity of the ejected material. This results in a reduced material consumption, due to increased incorporation into the depositing film, and promotes the stoichiometry at the level of the substrate. A better incorporation of Mg as a dopant in GaN MBE growth has been observed by several research groups using all-PBN crackers.

The all-PBN valve allows fast and efficient separation of the reservoir-evaporator unit from the chamber during growth. Thus, the valve can be implemented to minimize the background pressure of the evaporant in the chamber during the growth process. This is especially useful for the heteroepitaxial growth when extremely sharp layer interfaces are required.

An additional advantage of the valved source concerns the time required to resume operation of the source after the standby state. Due to very good tightness of the valve, it is not necessary to cool down the evaporant after the layer growth is completed. Instead, the valve is simply closed and opened again on starting the next run. Dead times for temperature ramp and stabilization, which may take as long as several hours with non-valved sources, are shortened down to a few seconds, needed to open or close the valve.

Technical Data

Mounting Flange	DN40CF (O.D. 2.75")
Dimensions in Vacuum	L=287mm, TL=302mm, D=36mm, DS=20mm, OL=507mm
Filament type	crucible, valve/tube and cracker: wire heater
Thermocouple	crucible: type K; valve/tube and cracker: type C
Bakeout temperature	200°C
Operating temperature	crucible: 100-650°C, valve/tube: 200-800°C, cracker: 300-1300°C
Cooling	crucible and cracker: integrated water cooling shroud
Cracking insert	PBN
Crucible	PBN, 130 cm ³
Option	rotary shutter (S); opening angle 90° ccw

