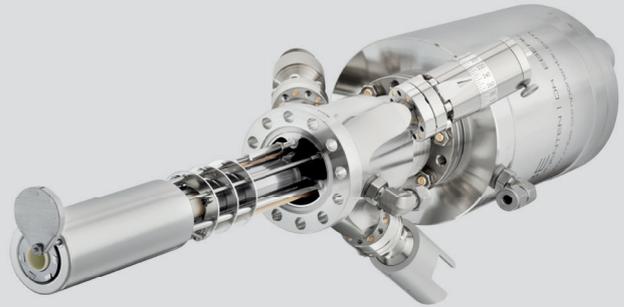


## THERMAL CRACKER CELL TCC

- All-PBN solution for corrosive materials like As, Se, Te, Sb or Mg
- Thermal activation for improved Mg doping in GaN
- Water cooled cracker working up to 1300°C
- 35 cm<sup>3</sup> or 130 cm<sup>3</sup> PBN crucible
- Excellent thermal isolation between low temperature reservoir and hot cracker zone
- Integrated rotary shutter



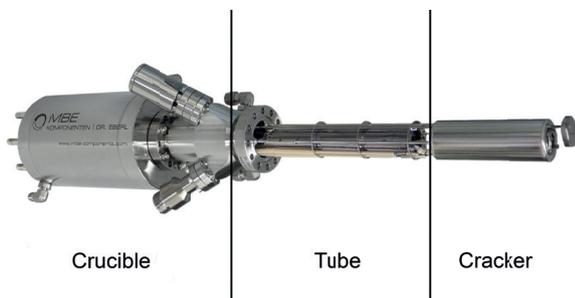
TCC 40-130-54-KS on DN40CF (O.D. 2.75") flange

The Thermal Cracker Cell TCC connects a low temperature effusion cell to a high temperature cracking stage with integral water cooling shroud. The whole assembly fits on a space-saving DN40CF (O.D. 2.75") flange. The TCC is available with capacities of 35 cm<sup>3</sup> or 130 cm<sup>3</sup> which are ideal for R&D applications. The use of standard crucibles with wide orifices facilitates the filling of even larger chunks of source material.

Corrosive vapor within the source gets only in contact with PBN parts. Due to its remarkable temperature gradient, the TCC allows for an excellent wide range flux control and does not require a delicate PBN valve mechanism. In addition, a special tantalum shutter cap can be used for fast on/off switching of the flux towards the substrate.

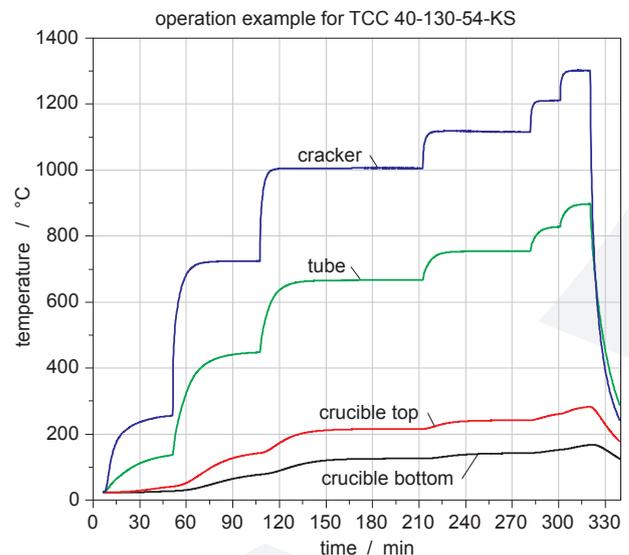
The TCC includes three different heating zones that provide substantial control on the temperatures in all kinds of applications. In many applications the tube heater is dispensable because the cracker heater provides sufficient heating power to prevent material condensation within the entire tube.

The TCC is designed to achieve a maximum possible differential temperature of more than 1000 K between crucible and cracker stage. The thermal crosstalk is repressed by means of excellent thermal isolation between the Ta wire heaters of the low temperature crucible and the hot cracking zone. This design provides a maximum flexibility in the cracking temperature range which helps to find optimum working conditions for different evaporation materials.



TCC zones

Integrated cooling of cracker, crucible and mounting flange effectively reduces the heat load on the chamber. That turns the TCC into a perfect source for research MBE systems and small sample preparation chambers.



TCC time-temperature diagramm for heating the cracker-heater only

## Applications

The Thermal Cracker Cell TCC is designed for evaporation of high vapor pressure materials like As, Se, Te, Sb or Mg at operation temperatures from 100°C to 650°C with an additional cracking stage that reaches temperatures up to 1300°C.

It is an efficient valve-free alternative to expensive and space-consuming PBN valved cracker sources. The cell concept unites stability and easy operation of a low temperature effusion cell with the option of cracking the larger atomic clusters or longer chains that often form by evaporating 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.

More perfect, i.e. less doped, crystal structures have been reported using cracker sources for epitaxial growth of topological insulators.

A better incorporation of Mg as a dopant in GaN MBE growth has been observed by several research groups using all-PBN crackers.

## Technical Data

Mounting Flange	DN40CF (O.D. 2.75")
Dimensions in Vacuum	L=220 or 287 mm, D=36 mm
Filament type	crucible, tube and cracker: wire heater
Thermocouple	crucible: type K; tube and cracker: type C
Bakeout temperature	200°C
Operating temperature	crucible: 100-650°C, tube: 200-750°C, cracker: 300-1300°C
Cooling	crucible and cracker: integrated water cooling shroud
	water flow rate 30-60 l/h
Cracking insert	PBN
Crucibles	PBN, 35 cm <sup>3</sup> or 130 cm <sup>3</sup>
Option	rotary shutter (S); opening angle 90° ccw

