

GaP Compound Source DECO



DECO 40-60, GaP compound source for P_2 on DN40 CF (O.D. 2.75") flange.

The GaP compound source DECO is an ultra pure source for P_2 based on the decomposition of GaP.

At typical operation temperatures of about 900°C - 1000°C GaP is decomposed to Ga, P_2 and P_4 . The P_2 flux is more than one order of magnitude higher than the P_4 flux. Additional cracking is not necessary and the accumulation of P_4 (white Phosphorus) is reduced to a minimum.

The all PBN Ga-Trapping Cap Unit of the DECO allow the escape of P_2 molecules from the cell while trapping parasitic Ga atoms efficiently. The very low parasitic Ga flux is more than three orders of magnitude lower than the P_2 -flux.

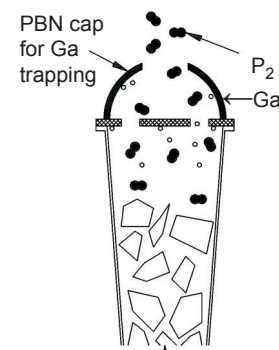
The DECO is as easy to operate as a standard group III effusion cell due to its high operation temperatures. This results in stable and reproducible flux adjustments.

The construction of the DECO is based on our standard effusion cells in combination with the PBN Ga-Trapping Cap System. Advantages are the easy mounting, compatibility to all MBE systems, high reliability and low cost. The operation of the small capacity DECO sources does not require complicated mechanical valves and controllers.

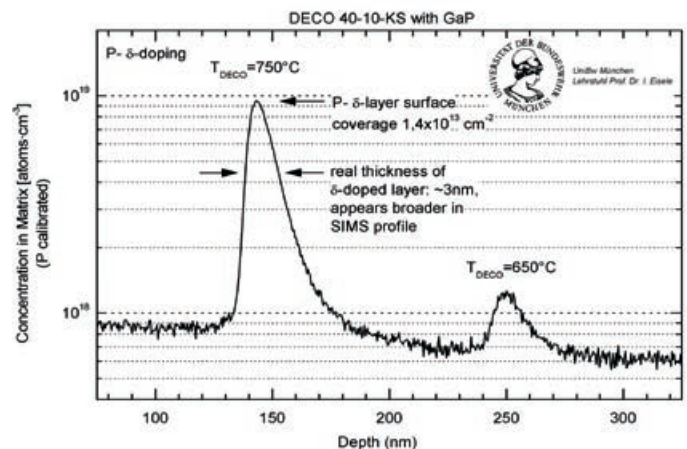
For large capacity sources we offer valved GaP compound sources VGCS. No additional safety facilities are needed in contrast to PH_3 sources.

The lower image shows sharp P-doping profile in Silicon after the deposition of two P- δ -layers. The experiment was performed at the Universität der Bundeswehr, Munich in Prof. Eiseles group.

- Compatible with all MBE systems
- Doping and growth applications
- Ultra high purity P_2 source
- Reduced white Phosphorus deposition
- Much reduced safety issues
- Easy operation
- High reliability
- Precise and fast flux control
- Large capacity valved sources



Single crystal GaP purity $>6N$
Schematic sketch of the Ga-Trapping-Cap.



SIMS measurement of the phosphorus concentration for P- δ -layers deposited at different source temperatures on Silicon. Using GaP with a DECO 40-10-KS results in sharp doping profiles.

Applications

Single crystal GaP material with a purity of >6N is recommended as source material. For growth application the DECO is optimized for high flux operation and maximum crucible charge, which allows long operation time without service or refilling. Typical phosphide compounds like AlGaInP, GaInP, GaAsP or InP can be grown.

For doping applications in SiGe-MBE the DECO is optimised for lower temperature operation. Small crucible charges, large double layer shutters, integrated water cooling and reduced shielding allows a fast shutdown of the cell after the doping. Sharp P-doping profiles are reported.

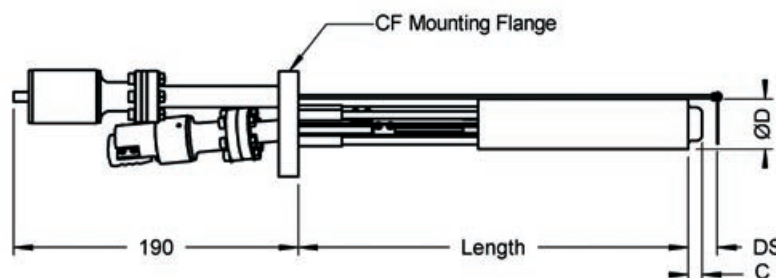
Due to its small dimensions and easy operation the DECO is ideally suited for applications in surface science and small sample preparation.

Technical Data

| | |
|-------------------------------|--|
| Mounting flange | DN40 CF (O.D. 2.75") or larger |
| Dimensions in vacuum | Length 220-400mm (user specific) |
| Filament type | Ta wire heating filament, optimised for growth or doping application |
| Thermocouple | W5%Re/W26%Re (type C) |
| Bakeout temperature | 300°C |
| Operating temperature | 500-800°C for doping sources; 900-1200°C for growth sources |
| Outgassing temperature | 1500°C |
| Crucibles | 10-200 cm ³ ; PBN crucibles |
| Options | integrated water cooling shroud (K), integrated shutter (S); source optimisation for growth (GA) or doping application (DA) |

Schematic drawing of the GaP compound Source DECO

(Drawing shows DECO 40-35-S)



References:

Growth application:

- [1] Growth of high-quality InGaP and application for modulation-doped structure by mbe with a GaP source. Shitara et al., Journal of Crystal Growth 1261,150(1995)
- [2] MBE Growth of High-quality InP for GaInAs/InP heterostructures using incongruent evaporation of GaP Künzel et al., Journal of Crystal Growth 175/176, 940 (1997)
- [3] Nanoscale InP islands embedded in InGaP A. Kurtenbach et al., Appl. Phys. Lett. 69,361 (1996)
- [4] Optical gain and lasing in self-assembled In/GaInP quantum dots A. Moritz et al., Appl. Phys. Lett. 69(2), 212,(1996)

Doping application:

- [6] Heavy phosphorus doping in mbe grown silicon with a GaP decomposition source G.Lippert et al., Appl. Phys. 66 (23) 3197 (1995)
- [7] P-d-doping in Si MBE C.Tolksdorf, I.Eisele, Uni-BW Munich, to be published

Surface science:

- [8] The InP (001)(2x1) Surface: A hydrogen terminated structure W.G. Schmidt, et al., Phys.Rev. Lett. 90, 126101 (2003)

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