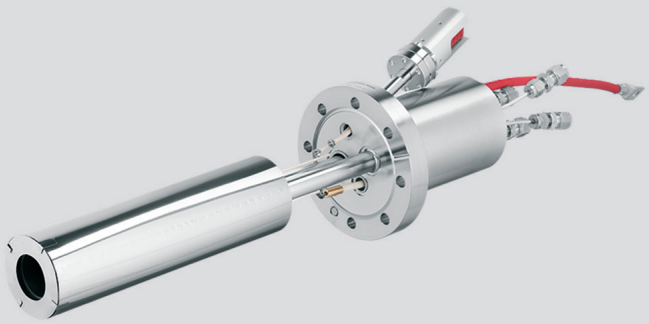
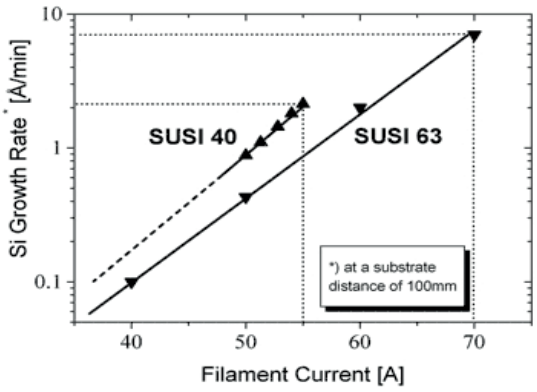
MBE
KOMPONENTEN | DR. EBERL

SILICON SUBLIMATION SOURCE SUSI

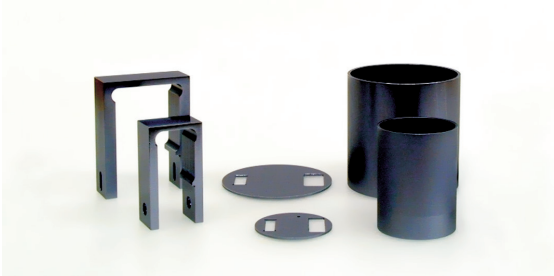
- Growth of thin Si layers
- Si doping in III-V MBE, with fast and precise flux control
- Ultra high purity silicon filament
- Water cooled electrical contacts
- Inner filament shielding with Si parts
- Low power consumption



SUSI 63 on DN63CF (O.D. 4.5") flange



Silicon growth rate of SUSI sources as a function of the electrical current



Highest purity silicon parts of the SUSI; filament arches, base plates, shielding tubes

The Silicon Sublimation Source SUSI was developed for growing thin Si layers, short period Si/Ge superlattices and Si/SiGe heterostructures, but it is also an excellent Si dopant source in III-V semiconductors.

The SUSI allows growth of high crystal quality thin epitaxial Si layers not otherwise possible with PBN crucible effusion cells. It is also an ideal alternative to e-beam evaporators, wherever highest purity, stable flux and low flux rates are required.

A specially designed free standing silicon filament arch is directly heated by electrical current and surrounded solely by high purity silicon shielding parts.

This provides for a very clean and constant Si flux at a low growth rate. Maximum growth rates of 7 Å/min and total layer thickness of 5 μm pure Si with one filament are reported.

Extreme heating of metal and ceramic parts is avoided by very effective water cooling of the electrical contacts, leading to minimum impurity emissions. No insulating ceramic parts are used in the hot zone.

While running the SUSI in a well designed MBE chamber at maximum growth rate a pressure in the 10^{-10} Torr range is achieved. The small thermal mass and the water cooled contacts allow rapid flux rate changes.

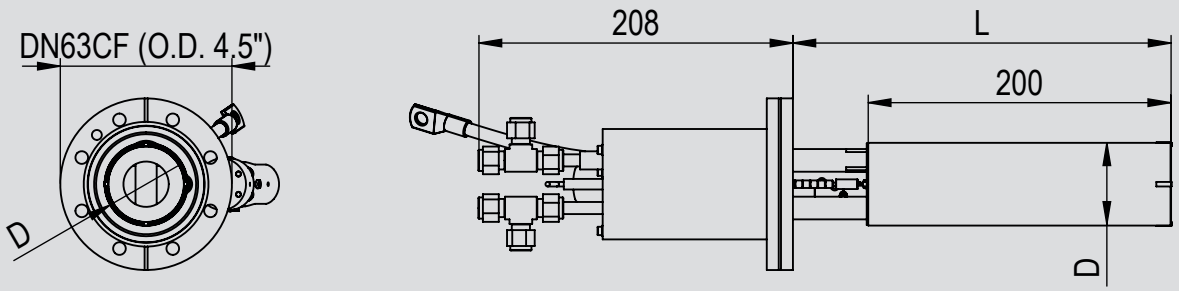
Applications

Special applications include boron and phosphorus doping in Si MBE. Highly doped Si source material is used in this case. Arsenic doped Si source material can be used for Si doping in GaAs MBE.
For doping in III-V MBE the required silicon flux usually is considerably lower than 0.1 Å/min. The electrical current providing such a silicon flux rate is between 20 to 35 A for the SUSI 40 and 40 to 50 A for the SUSI 63. These values may be used as a guide to start calibration of the doping level as a function of the current. Low power operation guarantees a long lifetime without any servicing.

Technical Data

Mounting flange	DN40CF (O.D. 2.75") for SUSI 40
	DN63CF (O.D. 4.5") for SUSI 63
Dimensions in vacuum	L=250-400 mm; D=36 mm for SUSI 40
	L=250-400 mm; D=55 mm for SUSI 63
High purity silicon filament	max. current 55 A; max. flux 2 Å/min; layer thickn. 2 µm (SUSI 40) *
	max. current 80 A; max. flux 7 Å/min; layer thickn. 5 µm (SUSI 63) *
Thermocouple	W5%Re/W26%Re (type C)
Bakeout temperature	max. 250°C
Outgassing temperature	max. 1100°C
Operating temperature	max. 1100°C
Cooling	integrated water cooled current contacts
Bakeout temperature	max. 250°C
Option	integrated rotary shutter (S) (for SUSI 63 only)

* max. flux and total layer thickness at 100 mm distance (source to sample)



Schematic drawing of the Silicon Sublimation Source SUSI
(Drawing shows SUSI 63)

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