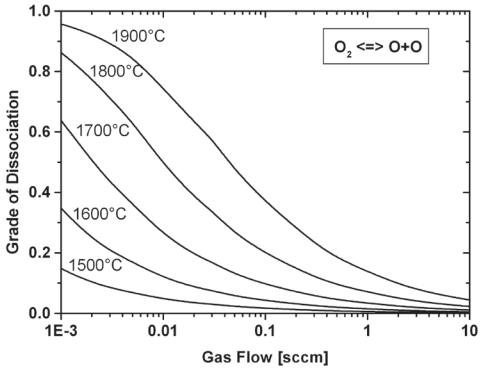
MBE
KOMPONENTEN | DR. EBERL

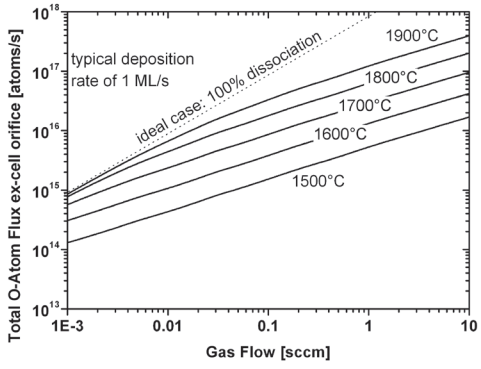
OXYGEN ATOM BEAM SOURCE OBS

- O_2 dissociation up to more than 80%, depending on operation conditions
- Atomic O-flux density up to $1x10^{15}/cm^2s$
- No high-energy particles and ions
- Low power consumption
- Integrated water cooling, low thermal load on other experimental equipment

OBS 40-A on DN40CF (O.D. 2.75") flange



Grade of dissociation as a function of the gas flow for typical cracking tube temperatures of the OBS (values are calculated for thermodynamical equilibrium condition)



Total flux of O-atoms leaving the cell orifice for different cell operation parameters (gas flow and tube temperature). A flux of about $1x10^{17}$ atoms/s corresponds to a typical deposition rate of 1 monolayer per second at a substrate distance of about 200 mm.

The Oxygen Atom Beam Source OBS is a thermal gas cracker that produces an ion-free oxygen gas beam, thus avoiding ion induced damage to the substrate. It features a very compact design and is easy to install and to operate.

Developed in collaboration with Dr. Karl G. Tschersich at Juelich Research Centre, the OBS is an extensively tested and well characterized oxygen source.

The centerpiece of the OBS is a long cracking tube heated by a surrounding filament. Operation temperatures up to 1800°C provide an efficient thermal cracking of O_2 molecules within the tube. The high purity cracking tube is the only part of the OBS with direct contact to the oxygen gas and forms a narrow angle distributed gas beam ejected toward the sample.
The narrow beam of the OBS allows high atomic oxygen flux rates at the sample position while keeping the O_2 background pressure of the chamber low as compared to plasma sources. Furthermore, the high cracking efficiency of up to 80%, which is available for low flux applications, reduces the chamber background pressure significantly as compared to ozone generators, with which the ozone concentration is limited to about 10-15%.

Despite the high temperatures needed for thermal gas cracking, the thermal load on the chamber is negligible, due to the integral water cooling.

MBE
KOMPONENTEN | DR. EBERL

Applications

The use of a long, slender cracking tube results in a narrow angle distribution of the atomic oxygen beam (typical FWHM: 10-30°), which makes the OBS ideally suited for medium and low gas flux applications (up to 0.1 sccm) on smaller sample sizes or long substrate distances.

Due to the highly efficient oxygen cracking mechanism and the resulting low gas load on the vacuum system, the OBS can likewise be applied in standard UHV, MBE and ALD systems as a reliable, highly efficient and low cost source for atomic oxygen.

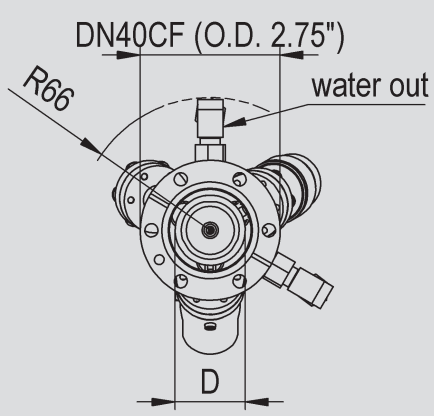
Typical applications for the OBS are:

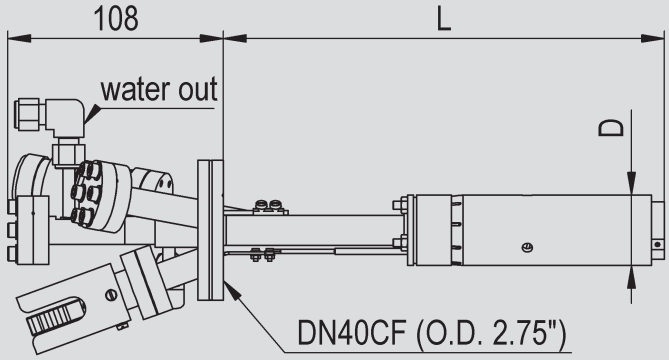
- Oxide layer deposition
- Surface cleaning procedures (e.g., removal of surface carbon contaminations)
- Surface oxidation (e.g., in ALD technology to form well defined oxide surface layers)
- Atomic spectroscopy of single atoms

Technical Data

Mounting flange	DN40CF (O.D.2.75“)
Dimensions in vacuum	190-400 mm
Filament type	Tungsten filament
Gas line	filament heated Ir capillary
Thermocouple	W5%Re/W26%Re (type C)
Bakeout temperature	max. 250°C
Operating temperature	up to 1900°C
Cooling	integrated water cooling
Options	aperture (A), integrated shutter (S)

References:
[1] K.G. Tschersich and V. von Bonin, J. Appl. Phys. 84, 4065 (1998)
[2] K.G. Tschersich, J. Appl. Phys. 87, 2565 (2000)
[3] V. Raballand, J. Benedikt, J. Wunderlich, A. von Keudell, J. Phys. D: Appl. Phys. 41, 115207 (2008)





Schematic drawing of the Oxygen Atom Beam Source OBS
(Drawing shows OBS 40)

Dr. Eberl MBE-Komponenten GmbH
Josef-Beyerle-Str. 18/1
71263 Weil der Stadt, Germany

Fon +49 7033 6937-0
Mail info@mbe-components.com
Web www.mbe-components.com