# RF Atom Sources

**MATS Series** Efficient, Clean, Reliable source of atomic O, H, N...
**Applications** Oxides, Nitrides, Hydrogen cleaning.

### Atomic Beams

Neutral, atomic species have been shown to be highly beneficial in the growth of high-quality compound materials. Molecular gases such as oxygen or nitrogen are many orders of magnitude less reactive than if dissociated into atomic form. Consequently, oxide formation using molecular oxygen commonly requires highly elevated temperatures and/or extended oxidation periods, while molecular nitrogen shows negligible reactivity for most materials. Using dissociated species increases the reactivity by many orders of magnitude. However, ionic species generated in plasma processes tend to be energetic, and will create point defects on impact with the growing film, rendering many films useless for their intended purpose. Atomic species, on the other hand, carry negligible kinetic energy and therefore allow rapid film growth without generating defects.

RF atom sources have been used with great success in many semiconductor film-growth applications, such as GaN, GaInNAs, ultra-thin Al2O3, high-K dielectrics and are being employed in a range of other applications such as data storage, catalytic films, and surface cleaning with atomic hydrogen.

### MATS-Series Unique Construction

MANTIS MATS-Series RF atom sources are designed for use in the most demanding applications. The coaxial RF coil is optimized for power transfer to the plasma zone, with full coupling along the entire length of the coil, ensuring even dissociation and maximum atomic flux. The support components are constructed in such a manner as to avoid RF coupling from the coil, hence further minimizing power losses. These components are also far removed from the coil, thus avoiding the possibility of accidental contact with the RF coil as is more common in other designs.

The discharge zone is manufactured from high-quality materials ensuring minimal contamination of the beam. The source incorporates a zero-ion current configuration as standard and can be fitted with a unique beam-thermaliser to reduce the energy of the small fraction of energetic neutrals which commonly emerge from all plasma-based atom sources.

The user can define the optimum gas flow by selecting from a range of different end-plates. These plates can be further customized to give maximum uniformity for a given sample size, distance and angle to the source.

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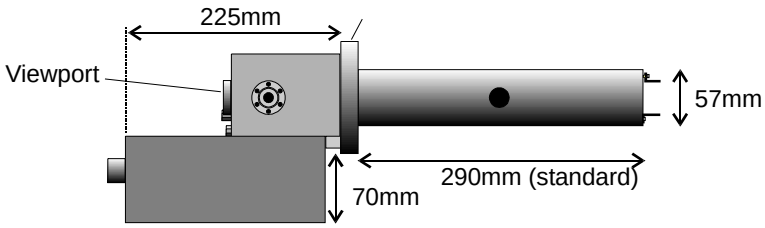
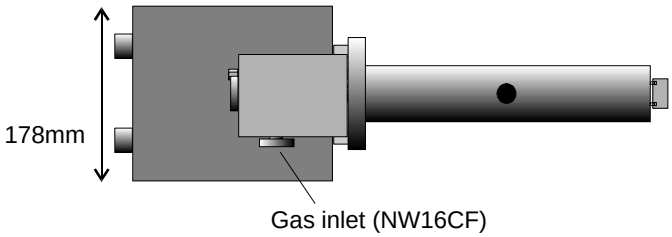
# MATS30 (not to scale)




| | MATS20 | MATS30 | MATS60 |
|---|---|---|---|
| Mounting flange | NW35CF | NW63CF | NW100CF |
| In vacuum length | 290mm (standard) | 290mm (standard) | 290mm (standard) |
| In-vacuum Diameter | 34mm | 57mm | 96mm |
| Gas Compatibility | $O_2$, $N_2$, $H_2$, $CH_4$... | $O_2$, $N_2$, $H_2$, $CH_4$... | $O_2$, $N_2$, $H_2$, $CH_4$... |
| Cooling | Water (0.5 l/min required) | Water (0.5 l/min required) | Water (0.5 l/min required) |
| RF Power | 40-300W | 30-600W | 30-600W |
| Gas Flow | 0.01-20 sccm (Aperture and gas dependent) | 0.01-20 sccm (Aperture and gas dependent) | 0.01-30 sccm (Aperture and gas dependent) |

# Accessories

**Plasma Emission Monitoring -** The source can be equipped with a plasma monitor and atomic line filter to allow optimisation of the plasma conditions for atomic flux generation. This option can be further extended by adding a ***mini-spectrometer*** to measure the relative intensity of all emission lines in the plasma.

**Automatic Matching Unit -** The manual matching unit can be replaced with an automatic matching unit to relieve the user of the task of making minor adjustments as plasma conditions change.

**Beam Thermaliser -** A beam thermaliser can be added to the end of the source to ensure that all atoms leaving the source are at thermal energy.

**Full PC Control, Manual Teardrop Shutter, Automated Teardrop Shutter.**

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