

2.45 GHz Microwave Plasma Source μ SLAN Free Standing Plasma Beam



Fig. 1: μ SLAN

DLC-deposition using a free standing microwave plasma beam in vacuum

A microwave generated plasma beam can be extracted out of the plasma source μ SLAN. The beam can be produced at a pressure range of about 0.5 mbar to 5 mbar and argon gas flows of more than 3000 sccm. The beam is bundled in vacuum although it is free, neither surrounded by any guiding structure nor confined by any external magnetic field.

Typical diameters are about 4 to 15 cm, the length is up to 0.6 m. The beam is characterized by low electron temperatures (0.5 to 0.8 eV) together with high electron densities (up to

10^{13} cm^{-3}) outside the plasma source. By adding C_2H_2 downstream to the beam, DLC films can be deposited on a biased substrate.

Typical deposition parameters
for DLC films grown on a Si substrate:

- MW power: 500 – 1200 W
- Substrate bias: -100 V to -500 V
(rf self bias or pulsed DC bias
(- 500 V / +50 V) at 2 kHz)
- Argon gas flow: 2000 – 8000 sccm
- C_2H_2 gas flow: 1000 – 4000 sccm
- Substrate temp: 60 °C
- Substrate distance from end of μ SLAN
quartz tube: 15 cm
- Deposition rates: 120 - 300 nm / min
- Coefficient
of friction: 0.05 – 0.07
- Coefficient
of wear: 100 – 1000 $\mu\text{m}^3/\text{Nm}$

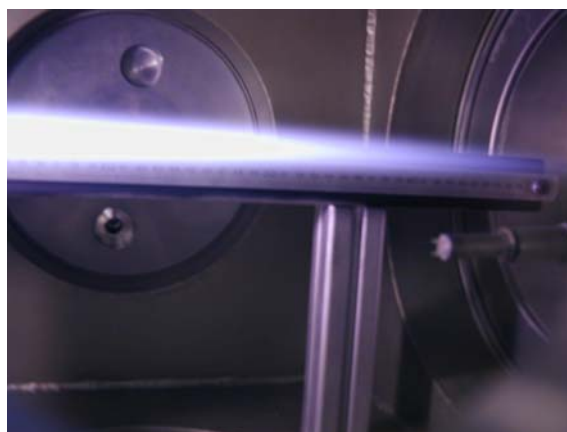


Fig. 2: free standing plasma beam (length 55 cm)



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