

Large Area Multifilamentary Plasma Source in LVPD - Upgrade

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A large area, circular shaped, uniform emission, multi-filamentary plasma source (*Dia* = 1.8m) designed, fabricated and installed successfully in Large Volume Plasma Device- Upgrade (LVPD-U) to facilitate investigations on unfolding non-linear features of pressure gradient driven and energetic electron induced plasma turbulence and consequence of whistlers on the growth of energetic electrons in a varying ambient magnetic field of $\leq 150G$. The plasma source consists of 162 number of hairpin shaped tungsten filaments (Length~ 0.18m and Dia~ $5 \times 10^{-4}m$) respectively. Each filament is mounted on a pair of stud type Molybdenum feed through's (Dia ~ 0.008m, Length~0.15m) making use of a chuck-nut fixing arrangement. The feedthrough's are accommodated on 08 numbers of water-cooled cassettes of copper conductor, powered by a DC power supply (10kA, 20V) utilizing in-house developed, vacuum interfaced feedthrough's. The plasma is produced by electron impact ionization of neutral Argon gas by applying a discharge voltage of 70V between cathode and anode using a power supply (100A, 120V).

The axial and radial plasma losses are contained by a pair of garlanded circular water-cooled coils (set of 10 coils) and combination of a pair of anode and end plates, mounted in the rear side of cathode and at its extreme opposite end. The pair of front and back plates are configured with a checker board magnetic field arrangement using $SmCo_3$ magnets (surface magnetic field ~0.4T). The present source (Dia.~ 1.8m, $n = 162$, emission area ~ $4.58 \times 10^{-2}m^2$) in LVPD-U has undergone significant deviation from its preceding rectangular line source ($n = 36$ nos., emitting area ~ $1.02 \times 10^{-2}m^2$) used in LVPD.

The paper will discuss primarily, design features of the plasma source, its mechanical assembly, salient features of its operation and some basic plasma characteristics.

References

1. S. K. Mattoo et al Rev. Sci. instrum 72, 3864 (2001).
2. L. M. Awasthi et al 2003 Plasma Sources Sci. Technol. **12** 158.
3. A. K. Sanyasi et al Phys. Plasmas **24**, 102118 (2017).
4. A. K. Sanyasi et al 2021 Plasma Phys. Control. Fusion **63** 085008.
5. Prabhakar Srivastav et al 2019 Plasma Phys. Control. Fusion **61** 055010.