# Seminar

# Institute for Plasma Research

**Title :** Design and Analysis of TWIN source extraction system (grids) with feasibility assessment on indigenous manufacturing

**Speaker:** Mr. Ravi Pandey
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**Date :** 03rd June 2020 (Wednesday)

**Time :** 03.00 PM

**Venue :** Online - Join the talk:
https://meet.ipr.res.in/Commitee1RaviPandey

**Abstract :**

Extraction system for TWIN source (**TW**O rf driver-based **I**ndigenously developed **N**egative ion source)) is a three grid system, comprises of plasma grid (PG), extraction system (EG) and ground grid (GG). The size of each grid segment is approximately 0.4×0.8$m^2$. The optics design of the TWIN source extractor system is similar to that of ITER-DNB having the 1/4th scale in overall size. Hence, considering the physics design of eight driver DNB grids, a conceptual 3D modeling of TWIN source grids has been carried out where a total of 320 numbers of apertures have been provided for each grid segment while the diameter of each aperture has been kept as 14mm, 12 mm and 15 mm for PG, EG and GG respectively. Each grid (PG, EG and GG) would be receiving differential thermal loads (heat flux) from ion source plasma which would give a temperature rise and stresses at the operating conditions. Hence the active cooling provision using an embedded cooling channel is to be provided, which will control temperature rise on the grid segment within allowable limits. Conventionally copper (Cu) electrodeposition technique is used to manufacture such embedded cooling channels in an oxygen-free high conducting copper grid.

In the present work, a cooling scheme based on analysis and indigenous manufacturing assessment has been selected out of a few possible options. A route of vacuum brazing has been considered to close the water cooling channels of the 3 grid segments. Cu to Cu vacuum brazing is an unconventional process for such large area grid manufacturing, considering the fact that conventional Cu electrodeposition manufacturing process for embedded cooling channels over a large area (grid segment area) is not possible in India as per present industrial scenario. The selected cooling scheme choice has then been utilized on a strip model (Grid segment) of TWIN Source grids to perform the thermo-mechanical analysis under operating load conditions (heat load and water flow conditions) to study thermal profile, stresses, out of plane deformations and aperture displacements (misalignment). The optimal geometrical requirements for establishing brazing to close the water cooling channels have been successfully realized on a prototype *stripped section* with embedded cooling channel manufactured indigenously and then the design is validated experimentally under similar load condition on the prototype section in the high heat flux facility at IPR. Grid design having ~0.0025 m size cooling channels of length ~ 0.8m long over ~ 0.4×0.8$m^2$ area considering vacuum brazing manufacturing feasibility is the novelty of the present thesis work.