Thermal Studies of ECRH Components under High Heat Flux

Abstract

Electron Cyclotron Resonance Heating (ECRH) is an important auxiliary heating method in magnetically confined fusion devices, where a high-power microwave beam is injected into the plasma. The interaction of the beam with metallic surfaces leads to partial power absorption, producing heat fluxes that can reach several MW/m².This project aims to develop an active cooling arrangement to manage these high heat loads during steady-state operation. Effective thermal management is essential to prevent material damage and minimize thermally induced surface deformation, which can degrade beam quality.

The work focuses on the thermal design and simulation-based evaluation of water-cooling schemes for non-uniform heat loading. It includes the study of cooling channel geometries tailored to Gaussian heat flux profiles and their assessment using thermal and/or CFD simulations. Performance will be evaluated based on peak temperature, temperature uniformity, and surface deformation. The outcome will be preliminary design recommendations and insights into key thermal design trade-offs for steady-state ECRH components.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: B.E./B.Tech. Mechanical Engineering

3) Academic Project duration:

(a) Total academic project duration: 6 Weeks
(b) Student's presence at IPR for academic project work: 5 Full working Days per week

Email to: hardik.mistry@ipr.res.in[Guide's e-mail address] and
project_me@ipr.res.in [Academic Project Coordinator's e-mail address]

Phone Number: 079 -2147 [Guide's phone number]