Seminar

==========

Institute for Plasma Research

==========

Title: Development of Cryocoolers for Cryopumps

Speaker: Dr. Abhinav B. Desai
Institute for Plasma Research, Gandhinagar

Date: 2nd September 2022 (Friday)

Time: 11:00 AM

Venue: Join the talk online:
https://lobby.ipr.res.in/Abhinav_Desai_PDF_Extension_Talk

Abstract

Vacuum plays a vital role in any cryogenic system including large fusion machines. Commercially available closed-loop refrigerator-based cryopumps can produce the required clean and oil-free vacuum. These cryopumps have wide applications in space simulators, thin film coating devices, semiconductor industries, etc. Currently, cryopumps are imported into the country. The demand for such cryopumps is high and hence there is a requirement to develop indigenous cryopumps. An attempt is being made to develop these cryogen-free cryopumps at the Cryopump and Pellet Injector Division (CPPI), Institute for Plasma Research (IPR).

An indigenous cryocooler is under development at the CPPI division, IPR, which will be augmented with cryo-panels and other parts to develop cryogen-free cryopumps. For this, two types of pulse tube cryocooler (PTC) prototypes, Stirling type PTC and single stage Gifford McMahon type (GM) PTC, are under development. PTC as an integrated system comprises a Helium compressor, a pressure distribution valve – rotary valve (for GM PTC), a regenerator, and a pulse tube. This GM PTC prototype of a single-stage, low-frequency, double inlet, orifice type is tested at low pressure (3 bar to 9 bar) using a three-way solenoid valve and achieved a no-load temperature of 232 K. To improve the performance of the PTC, choice, and use of the regenerator material is very vital and therefore regenerator optimization study is carried out. Through theoretical optimization, the importance of using a multi-material regenerator is conceptually verified, and a way to use a multi-material regenerator is identified in the form of an algorithm. Now the prototype of GM PTC is ready to be used with a multi-material regenerator in the form of a multi-layer regenerator to validate the optimization algorithm.