Design and analysis of a Printed Circuit Heat Exchanger (PCHE) for high pressure high temperature helium applications

Abstract

A high-pressure (10 MPa) and high-temperature (450°C) Experimental Helium Cooling Loop (EHCL) facility has been commissioned at Institute for Plasma Research (IPR). The loop consists of a recuperator (Helium-Helium heat exchanger) based on Printed Circuit Heat Exchanger (PCHE) technology. Printed Circuit Heat Exchangers (PCHEs) are highly compact and efficient heat exchangers that are increasingly being used in advanced energy systems such as nuclear reactors. Their micro channel-based structure enables high heat transfer rates, excellent structural strength, and operation under extreme temperature and pressure conditions. Its compact design make it an attractive component for advanced design and detailed thermal analysis studies.
One of the objective of this project is to perform preliminary thermal design based on the available reports and datasheet of EHCL recuperator. This work includes performing detailed literature review on selecting geometrical parameters of PCHE and selecting analytical correlations. Based on selected geometrical parameters and preliminary thermal design, a detailed CFD based thermal-hydraulics study using tools such ANSYS shall be performed. This work will provide insights into temperature distribution, velocity profiles, and pressure losses within the exchanger. Key deliverables are a detailed report on thermal design calculations and CFD simulation results. Expected project duration is 9 months.

Academic Project Requirements:

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

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

3) Academic Project duration:

(a) Total academic project duration: 36 Weeks
(b) Student's presence at IPR for academic project work: 2 Full working Days per week

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