

# Seminar

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## Institute for Plasma Research

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**Title:** Optimization of Circulation Power in High Temperature Reactors using Helium-Carbon dioxide (He-CO<sub>2</sub>) Binary Gas Coolant as a replacement of Helium

**Speaker:** Mr. Ankit Gandhi  
Institute for Plasma Research, Gandhinagar

**Date:** 29<sup>th</sup> July 2022 (Friday)

**Time:** 03:30 P.M.

**Venue:** Committee Room 3, (New Building), IPR

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### Abstract

Helium (He) Gas is widely used as a coolant in high temperature reactors due to its good transport and thermal properties. Helium Gas has found applications in cooling systems of High Temperature Gas cooled Reactor (HTGR), breeding blankets of ITER and DEMO reactors.

A major disadvantage of Helium is its extremely low density, which requires high input circulation power for the compressor. Recent studies have shown that mixing of Helium with a relatively dense gas like Carbon dioxide (CO<sub>2</sub>), Xenon (Xe), Krypton (Kr), etc may mitigate the disadvantage of Helium low density.

In the present work, a numerical analysis of First Wall (FW) channels of breeding blanket was performed for Helium Gas and He-CO<sub>2</sub> binary gas mixture. CFD tools were used to compare the thermal-hydraulic performance of FW channels using Helium Gas and He-CO<sub>2</sub> binary gas mixture. It has been found that He-CO<sub>2</sub> mixture in an optimum mole fraction range of 0.4-0.5 reduces circulation power by an order of magnitude compared to Helium Gas, while meeting the thermal requirements of the FW channels.

**Keywords:** Helium, He-CO<sub>2</sub>, First Wall

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