Study of Electrical Aspects of High Temperature Superconductor (HTS) based Cables and Current Leads

Abstract

The Institute for Plasma Research (IPR) is a globally recognized research facility specializing in both fundamental and applied studies in plasma physics, thermonuclear fusion, fusion technologies, societal applications, & other related fields. It undertakes a variety of research projects on diverse topics within this domain. Additionally, it is home to Steady State Superconducting Tokamak (SST-1), which is utilized for the investigation of tokamak plasma physics under strong magnetic fields and exploration of future fusion technologies.

Superconductivity is a phenomenon where specific materials demonstrate zero electrical resistance & repel magnetic fields when cooled below a certain critical temperature. This project is designed to investigate the application of superconductivity in various electrical applications, with a particular emphasis on HTS power cables, current leads, and their electrical characteristics under operational temperature & magnetic field conditions. The project will encompass the fundamental principles of SC materials, different types of superconductors, and their operational design requirements, such as electrical insulation, structural integrity under induced electromagnetic forces and cryogenic cooling. Furthermore, the study will analyze existing large-scale HTS based installations globally, emphasizing their performance and economic viability. It will also address technical challenges related to HTS applications for instance the anisotropic behavior and strain sensitivity of the HTS material, their electro-technical performance, interface joints, handling off-normal events and operational reliability under stringent cryogenic conditions. The results of this project will yield a thorough insight into how superconductivity can revolutionize contemporary electrical power networks and technical challenges that can aid in the development of efficient, high-capacity, and environmentally sustainable power transmission systems moving forward.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 2

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

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

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