Seminar

Institute for Plasma Research

Title : Mechanical, Electrical, Magnetic and Thermal Analysis on High Temperature Superconducting Magnet used for Power Grid Applications

Speaker: Dr. Abhinav Kumar
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Date : 25th August 2020 (Tuesday)

Time : 03:30 PM

Venue : Online - Join the talk: https://meet.ipr.res.in/Dr.AbhinavKumar_PDFtalk

Abstract :

Among various available energy storage systems, it has been found that Superconducting Magnetic Energy Storage (SMES) systems have merits over the others as they can provide much higher power densities and response time is also better than other bulk energy storage systems like hydro and CAES. In PhD, Mechanical design of the 1 MJ of solenoidal superconducting magnet at 77 K temperature has been studied thoroughly where all design parameters have been identified along with the constraints and input parameters involved. Effect of operating currents or different load factors, solenoid thickness and operating temperature on the magnet topology has been studied. Effect of self-field on the critical current of the superconducting tape wounded as a coil has been studied. 2D model has been developed where the stacked tapes along with the number of turns has been modelled using COMSOL MultiPhysics software. It has been found that self-field can affect the critical current of the coil significantly and this aspect cannot be ignored while designing the SMES system for large scale applications. AC loss analysis for a 2D homogenous model has been studied for different operating currents and number of turns around the pancake coil. H-formulation modelling has been used in order to evaluate the AC losses. It has been found that with the increase in the load factor or operating current and number of turns around the pancake coil for a particular tape at 77 K temperature, the average AC losses are found to increase exponentially. Effect of interfacial resistance on the Normal Zone Propagation Velocity (NZPV) has been studied and it has been found that with the increase in the resistance, the NZPV is increasing thus tape can be prevented from the quench if the interfacial resistance among the stabilizer and superconducting layer is kept more and this system can act as flux flow diverter.