

Seminar

Institute for Plasma Research

Title: High Voltage Energy Storage Capacitors
Speaker: Dr. R K Sharma
Bhabha Atomic Research Centre (BARC), Mumbai
Date: 16th October 2024 (Wednesday)
Time: 11.45 AM
Venue: Seminar Hall, IPR

Abstract

High voltage (HV) pulsed power systems are integral to numerous advanced technologies. The applications spans from scientific research and defense to medical technologies and industrial processes. These HV pulsed power systems rely on the rapid delivery of substantial energy in short bursts, making efficient energy storage crucial. Effective energy storage solutions ensure that these systems operate reliably and with the necessary power output. This talk will explore various energy storage technologies employed in high voltage pulsed power systems, including capacitors, inductors, flywheel, energetic material, among others. The demands from an energy storage device for various HV pulsed power applications is very important aspect to understand. Principle of operation, efficiency, and energy density of each technology, with a focus on how they impact the performance of pulsed power systems will be presented. Inductive, flywheel and energetic material based storage systems with their critical components will be reviewed for their potential to enhance system performance and reliability.

HV capacitors, particularly those utilizing polymer film materials with high electric field & dielectric constants, will be emphasized in this talk for their ability to deliver high power densities and fast discharge rates. There are two types of pulse discharge capacitors; foil and metalized electrode (MPP) type. Both foil and MPP type capacitors will be presented in detail, starting from the raw material tests, dry element windings, oil/resin vacuum impregnation and finally electrical testing as per Indian Standards: 13666, 1993. The effect of various electrical and environmental parameters on the capacitor life will be discussed.

This talk will be concluded with presentation on the HV capacitor development work at CnID, BARC, an assessment of current challenges and future directions of capacitor energy storage solutions for high voltage pulsed power systems.
