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Seminar

Institute for Plasma Research

Title: Design of a Microwave Cavity perturbation Based System for Solid Hydrogen Pellet Mass Measurement

Speaker: Dr. Rohit Kumar Saini
Institute for Plasma Research, Gandhinagar

Date: 14th November 2022 (Monday)

Time: 10:00 AM

Venue: Seminar Hall, IPR

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Abstract

The cavity perturbation method has been used to measure the permittivity of various dielectric materials such as Teflon, Nylon and Polyethylene etc. at S-band frequencies. To measure the mass or volume of small size pellets of solid hydrogen (H₂) in high speed motion in pellet injector system, this cavity perturbation method is used as a non-destructive method. The measurement of mass and speed of frozen pellets of H₂ and D₂ in injection system is essential in order to completely understand the behaviour of magnetically confined plasma. In this technical report we have designed circular cylindrical cavity for TM₀₁₀ mode at 3.1GHz. In TM₀₁₀ mode the sensitivity of the measurement is high as the pellet trajectory is along the maximum electric field intensity inside the cavity. Due to the property of high sensitivity of the mode TM₀₁₀ and high quality factor, the microwave cavity perturbation method, for measurement of mass of small size pellets of D₂ and H₂ whose dielectric constant is almost equal to one ($\epsilon_r \approx 1$) in injection system is commonly utilized. In this technical report we have used pellets of Teflon and nylon of different sizes. A number of tests have been performed and experimental results will be reported.
