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M2Or1C-02: In-house development of high neutron resisted insulation material for superconducting magnets fusion machines and 77 K, 4.2 K applications

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In superconducting magnet system of fusion machines, glass fiber reinforced composite insulation material is the main candidate which is used for insulation material of superconducting magnet coils, Electrical insulation breaks, structural and support material for electrical isolation. Even after blanket shielding, the irradiation effect of neutron, degrades the properties of insulation materials and components which overall effect the performance of fusion reactor. Mechanical properties especially tensile strength and inter laminar strength degraded significantly due to neutron. The composite insulation material consists of boron free S glass and a high toughness two component epoxy resin system have been in-house developed. The components were fabricated from this insulation material which has passed in quality assurance acceptance and operation performance tests. In past, this Insulation material have been irradiated in KAMINI U-233 fuelled Fission Reactor with nominal power 30 kW, the neutron fluence have achieved up to 1.03 x 10E17 n/m2. No degradation was reported during mechanical and electrical performance testing. Further to continue the task for acceptable radiation tolerance limit and ITER design criteria of GFRP insulation material of fast neutron fluence 10E16 to 10E18 n/cm2 an irradiation experiment set up has been designed and the irradiation experiment is under process in Fast Breeder Test Reactor. In this paper, we shall present the mechanical and electrical performance tests as Tensile, Inter laminar shear and electrical breakdown strength as per the ASTM standards, assessment of micro-structure surface degradation before and after irradiation and MCNP simulation for neutron flux, dose and damages in developed insulation material. In-house development and performance of cryogenic components, epoxy resin system for cryogenic applications will also be highlighted.

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