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Progress of ITER Feeder System Electrical Insulation Qualification

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The ITER Feeder is an important sub-system which transmits the electrical power, conveys the cryogenic coolant and carries the instrumentation wires to the ITER Tokamak magnet system. In the Feeder, all the high voltage (HV) potential components, including the high temperature superconducting current leads, the superconducting busbars, and the busbar joints, need to be insulated with solid composite materials to electrically isolate the HV potential from ground. Due to the complex external configuration, especially at the transition position on current lead and joint, it is difficult to apply the insulation layer on the surface of the components. At the start of the feeder insulation project, ASIPP trialed several alternative technologies, such as the vacuum pressure impregnation (VPI) technology, the “wet-winding” technology, and the pre-impregnated tape (pre-preg) winding technology. Based on over two years of preliminary qualification and experimental comparison, the pre-preg tape and relevant curing techniques were finally chosen as the formal Feeder insulation material and method. The formal insulation qualification was launched, including the material qualification and the component (process) qualification. This paper describes the whole research improvement of ITER Feeder electrical insulation qualification activities, introduces the selection of procured materials and the manufacturing trials, and summarises the formal qualification items and their test results. ASIPP has now completed the static tensile/shear strength, the fatigue tensile strength, the compression-shear strength, and the void content test for the material qualification. Insulated mock-ups of the busbar joints have current lead have been manufactured and electrically tested.

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