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P4.082 Design and optimization of vacuum pressure impregnation mould for large scale superconducting coils

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The Poloidal Field (PF) coils are one of the main sub-systems of the ITER magnets. Fusion for energy (F4E) is responsible for supply five of them(PF2-PF6) as in-kind contributions to ITER project. ITER PF6 coil is being manufactured by the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP) as per the Poloidal Field coils cooperation agreement signed between ASIPP and F4E.
The technology of design and construction of superconducting coils has evolved dramatically over the last decades. The very large and complexity coils are demanded by fusion technology, where the Vacuum Pressure Impregnation (VPI) technique has become the most common process for the consolidating electrical insulation of large superconducting coils. To achieve success with the VPI process, superconducting coil is contained within a vacuum chamber of VPI mould to prevent resin leakage under operating conditions. This paper is focusing on the design and optimization of VPI mould of the mock-up of the pre-winding pancakes (PWPs), one-tenth of the ITER PF6 winding pancake (WP). The mock-up weighs 30 tons and is 1.2 m high, its VPI mould need meet three main requirements. 1) adequate structure strength, 2) pumping for coil de-gasing at 110 ℃ and resin curing at 130 ℃, 3) using over-pressure to force resin into the coil structure. Using structure mechanics and thermodynamic analysis with finite element (FE) to optimize the VPI mould model. In addition, getting experimental figures of the VPI mould from actual VPI process of the mock-up, to compare with the optimized VPI mould model, to optimize the VPI mould further. The results show that VPI mould of the mock-up can meet requirements of VPI process.

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