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ITR/P5-10: Status & Progress of the R&D Work for ITER Magnet Supports

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Magnet supports is designed as class A quality components, because these components should sustain all the dead weight of magnet coils, thermal load, electromagnetic forces, and seismic loads if occur. China will supply all the supports for ITER construction. First of all, selection the suitable technical road for the final high quality components is important. It is estimated that several thousand tons of various type 316LN stainless steel including hot-rolled plate, forged blocks and pipes, is needed for all the magnet supports. Last year, the large-size forged block for PFS6 (total weight up to 10T) was developed domestically. Both the plate and the forged block showed high strength and good elongation at room temperature and 4.2K. In addition, almost no ferritic phase could be seen. Furthermore, we have developed a special NDT (non-destructive test) method to detect the defects for more than half meter thick 316LN austenitic block. A new design for GS manufacture without welding was put out, the static stress analysis using three-dimensional finite element model (FEM), was developed to analyze the redesigned structure. It can be known that the stress in the present load condition/combination is under the stress limitation of the material. In order to further check the engineering stability of this support under various possible work condition, a special test platform, which can simulate all forces during ITER operation, to check the prototype TF pedestal was designed and constructed. Various cooling pipe is needed for maintaining the low temperature of the magnet supports. We develop laser brazing method to reduce the heat input and then improve the connection, and the microstructure observation shows that almost no microcrack could be found. In the ITER magnet system, more than 10000 various bolts and tie rods will be used, the material include Inconel 718, A286 and 316LN. We have successfully developed the fastener fabrication technology. The fastener qualification is an important work to guarantee the structure safety of magnet supports. The engineering test of the fastener, for instance, tensile strength, fatigue at 77K is developed in our institute. The further test is in schedule.

Country or International Organization of Primary Author

China

Collaboration (if applicable, e.g., International Tokamak Physics Activities)

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