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Mechanical Properties of High Manganese Austenitic Stainless Steel JK2LB for ITER central solenoid jacket material

A suite of advanced austenitic stainless steels are used for the superconductor jacket, magnet casing and support structure in the ITER TF, CS and PF coil systems. These materials will be exposed to cyclic-stress environment at cryogenic temperature. The CS jacket suffers high electromagnetic force with 60,000 cycles during its life time. Therefore, high manganese austenitic stainless steel JK2LB, which has high tensile strength, high ductility, and high resistance to fatigue at 4K has been chosen for the CS conductor. The cryogenic temperature mechanical property data of this material are very important to ITER magnet design but not much data were available. This study is focused on mechanical characteristics of JK2LB and its weld joint. Weld joint samples of JK2LB with compaction, bending, straightening, and aging heat treatment were prepared and tested. We present results from tensile tests, fracture toughness (KIC(J)), fatigue crack growth rate and fatigue (S-N) at liquid helium temperature (4K). In the fatigue testing of welded joint, specimens were machined as-welded to evaluate real fatigue characteristic including stress concentration at weld joint, and tests were carried out. Test result of tensile tests, fracture toughness and fatigue satisfy the ITER requirements. Furthermore, the measured fatigue crack growth rates are low enough to achieve the operation cycle of the CS coil.

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