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Effect of Change of Aging Heat Treatment Pattern for JK2LB Jacket for ITER CS

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The Japan Atomic Energy Agency (JAEA) is responsible for procurement of the central solenoid (CS) conductor for ITER. The CS conductor is assembled by pulling Nb₃Sn superconductor cable into circular-in-square jacket whose material is JK2LB high manganese stainless steel developed by JAEA, and then heat treatment is carried out. In the recent study of Nb₃Sn strand, heat treatment pattern including 570 degrees Celsius up to 250 hours and 650 degrees up to 200 hours is adopted. For CS jacket, it was verified that heat treatment for 200 hours at 650 degree does not cause disqualification for the ITER requirement in the past study. However, a case at 570 degree was not studied yet. Generally, there is a possibility austenitic stainless steel is induced sensitization near the temperature of Nb₃Sn reaction. So the effect of the difference of heat treatment pattern was checked in this study.

For this study, CS jacket sample which was demonstrated bending and straightening process of coil manufacture was cut in half and the one is heat-treated for 250 hours at 570 degree and then 200 hours at 650 degree. Another one is heat-treated only for 200 hours at 650 degree. These 2 samples were compared in terms of mechanical test at 4 K and metallographic tests. The mechanical test results showed both samples did not show any difference and satisfied ITER requirement of more than 1150 MPa in ultimate tensile strength and 130 MPam^{1/2} in fracture toughness K_{IC}(J). Also in the metallographic tests, including microstructure observation, inclusion and corrosion test, there are no differences found. This study proved JK2LB jacket can be applicable to a heat treatment pattern of 250 hours at 570 degree and 200 hours at 650 degree.

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