

MECHANICAL CHARACTERISTICS OF AUSTENITIC STAINLESS STEEL 316LN WELDMENTS AT CRYOGENIC TEMPERATURE¹

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Austenitic stainless steels are the most widely used alloys for structural materials at low temperature. Nitrogen-strengthened austenitic stainless steel (type 316LN) as commercial grade is preferred to the large superconducting magnets due to its excellent physical and mechanical properties at cryogenic temperature. Korea Superconducting Tokamak Advanced Research (KSTAR) also has chosen this grade for the magnet support structure. This huge structure, however, should be manufactured with heavy and thick weld section to endure operating high magnetic force. Thus weld properties are very important to ensure the structural soundness. The design criteria of the KSTAR magnet structure require the 0.2 % offset yield strength more than 750 MPa for base metal and 90 % of base metal for weld metal. As for the fracture toughness, it needs more than 150 MPa m^{1/2} for base metal and 130 MPa m^{1/2} for weld metal. For thick welds, it is commonly known that GTAW(Gas Tungsten Arc Welding) and EBW(Electron Beam Welding) method may achieve good properties. In this study, the mechanical tests at both room and cryogenic temperature are performed for verifying and qualifying the weld properties for two weldments including base metal.

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