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Superconducting Joints of *In Situ* PIT and IMD Processed MgB_2 Conductors

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Superconducting joints are essential to use magnesium diboride (MgB_2) conductors in liquid helium (LHe)-free magnetic resonance imaging (MRI) magnet system operated in a persistent mode by forming a closed-loop using superconducting joints. *In situ* PIT (powder-in-tube) processed multifilament MgB_2 conductors are known to have good potential to use in LHe-free MRI magnet. However, internal magnesium diffusion (IMD) processed MgB_2 conductors show superior performance compared with *in situ* PIT processed MgB_2 conductors. Therefore, if high current capacity joints using IMD conductors can be fabricated, it will be certainly advantageous. We have fabricated superconducting joints using unreacted multifilament (18 + 1) *in situ* PIT and monofilament IMD processed MgB_2 conductors and evaluated their performance in different temperatures up to 25 K and magnetic fields up to 12 T. Our joints fabricated using 18 + 1 filaments *in situ* PIT and monofilament IMD processed conductors attained critical current of 121.7 A at 10 K in 0.5 T and 128.6 A at 20 K in 1 T, respectively. The current retention in the joint fabricated using IMD processed conductors in compared with the bare wire was close to 100% at 20 K in the field range from 7 T to 2 T. The joint resistances evaluated using the field-decay measurement by forming a closed-loop of the *in situ* PIT and IMD processed conductors were 5.16×10^{-15} Ω and 2.01×10^{-13} Ω at 20 K in self-field, respectively. The detailed joint fabrication process, transport measurement results, microscopy analysis of the joint part, and the field-decay measurement results of both types of joints will be presented.

Keywords: Magnesium Diboride (MgB2), Magnetic Resonance Imaging (MRI), Superconducting Joints