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High Strain and Twisting Tolerance in AIMI and PIT MgB₂ Strands

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The influence of strand bending and twisting on the critical current density, J_c , and n -value of MgB₂ multifilamentary strands were evaluated, and the field and temperature dependence of the transport properties was evaluated for MgB₂ strands. Two types of MgB₂ strands were fabricated; (i) advanced internal magnesium infiltration method (AIMI) strands, and (ii) powder in tube method (PIT) type strands. The bending strain tolerance of MgB₂ strands was studied by applying a series of bending strains (0.0% to 0.8%) at room temperature, and then measuring transport properties at cryogenic temperatures. In order to study the effect of twisting, six twist pitch levels (10 mm to 100 mm) were applied on PIT MgB₂ strand with 54 sub-filaments. Critical current densities of all samples in this study were measured on 5 cm long samples at 4.2 K in fields of up to 12 T. The n -values (or index number) were extracted from the V-I curve at all measured fields. The bending strain tolerances on the transport properties of both AIMI and PIT strands were measured and discussed. The influence of twisting on multifilamentary PIT strand was studied. Transport measurements were performed on the AIMI strand as a function of T from 4.2 K to 30 K. For AIMI strands, the strain dependence of J_c and n -value were undegraded out to 0.4%, with a reduction of only 10% at 0.6% bending strain. For PIT strands, both J_c and n -value were independent with bending strain up to 0.4%. Twisting down to $L_t = 10$ mm did not degrade the 4.2K transport properties of the MgB₂ multifilamentary PIT strand (sub-filament size of ~ 20 μ m).

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