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M2Po2D-02 [44]: Experimental studies on the contact resistance and current sharing of superconducting CORC cables

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$RE - Ba_2Cu_3O_{7-}$ (REBCO, RE = rare earth) coated conductors maintain high current densities in the presence of large magnetic fields, making REBCO a promising conductor for use in high magnetic field applications. Unfortunately, the manufacturing process produces defects, resulting in significant drops in the critical current, I_c, along the length of the conductor. Additional variations in I_c can occur due to the anisotropic behavior of REBCO with respect to magnetic field orientation, which can reduce I_c by a factor of 2 depending on field orientation at 77 K. Conductor on Round Core (CORC) cables contain multiple layers of helically wound REBCO tapes, producing a flexible, isotropic conductor that promotes current sharing between layers. This could allow current to bypass local drops in I_c and minimize the risk of hot spot formation. The current sharing capability of CORC cables depends on the tape-to-tape contact resistance, R_c, which can be quite large since the tapes in CORC cables are not generally soldered in order promote cable flexibility. Measurements were conducted on several CORC cables to achieve a better understanding of how different winding parameters, cable bending, and magnetic field affect R_c. We found that R_c can take on values from 10 to over 1,000 $\mu\Omega \cdot cm^2$, resulting in a broad range of current transfer length between layers. Further experiments isolated 1 or 2 tapes with a significant drop in I_c for detailed studies, from which the effects of current transfer were evident on the current-voltage transition data. We compare cables that permit current transfer around these I_c drops to cables with insulation between tape layers, disabling current sharing, allowing us to clearly see the impact of current sharing on cable I_c.

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