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M3Or4M-03: [Invited] Resistivity ratios for high purity aluminum in magnetic fields

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Ultrahigh conductivity Al (Al hyperconductors, RRR ˜10ˆ4) has the capacity to be competitive with superconductors at cryogenic temperatures. High-purity Al (HPAL) conductivity has the benefits of not being dependent on a transition temperature, Tc, allowing for a wider range of operational temperatures, and has lower ohmic heating contributions than superconductors in high-frequency bands. However, its low yield strength makes for a difficult manufacturing process and is unfeasible for applications with high applied field. To remedy this issue, a metal matrix composite (Cu-30Ni) is used around the aluminum core to increase the conductor strength, while ensuring high performance in the aluminum by limiting the interdiffusion between the materials. We report the resistivity ratio (RR) as a measure of how well the HPAL is preserved for various metal matrix composites around the aluminum core in an applied magnetic field for temperatures from room temperature down to 4 K. We also explore the aluminum cold work degradations during wire drawing and proper heat-treatment methods to recover the high RRR without introducing undesired imperfections from the metal matrix. We then compare the RR values for multifilamentary conductors designed for AC loss applications with non-altered conductors to see any variations in performance.

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