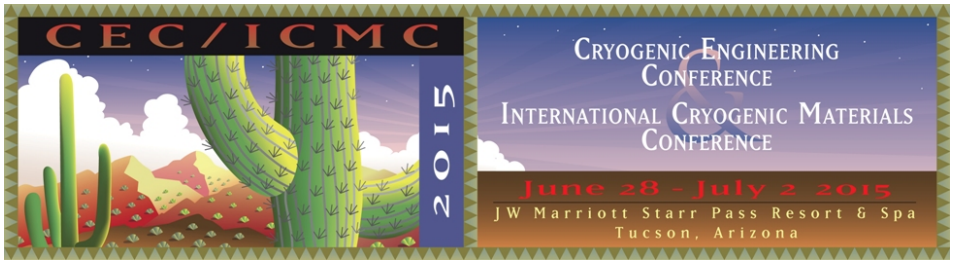

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Physical properties of material useful for predicting stability and quench propagation in high-field Bi-2212 magnets

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Quench initiation and growth in high-field Bi-2212 magnets can be described by 3-D heat diffusion equations and well simulated using modern finite element modeling tools. However, the usefulness of this simulation is often limited by the lack of good physical properties of important components, such as the magneto-resistivity of silver and silver alloys in a heat-treated commercial wire, which may or may not suffer from reduction of residual resistivity ratio due to Cu loss from the Bi-2212 filaments into the silver matrix. Further uncertainty arises from the fact the Cu loss depending on heat treatment parameters and Cu has different solubility in different silver alloy wires, and the fact that heat treated Bi-2212 wires have a Tc of up to 92 K, making difficult measurement of resistivity of silver at 4.2-90 K. In this study, we measure the temperature dependence of the resistivity of Ag, Ag-0.2wt%Mg, AgAl, and several commercial Ag/Bi-2212 wires, in magnetic field up to 9 T from 300 K down to 4.2 K. Wires to be measured include a wire with pure silver sheath, a wire with Ag and Ag-0.2wt%Mg sheathes, and a wire with Ag and AgAl sheathes. Critical current temperature and critical fields of these wires will also be determined. We also measured the thermal conductivity of silver and epoxy (CTD101k). These data will be fed into a finite elemental model (COMSOL), developed here at Fermilab and bench marked with experimental data at 0-7 T, to study the high-field quench behavior of Bi-2212/Ag conductors in fields up to 30 T.

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