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M1Or1C-05: Cryoresistive aluminum-beryllium nanocomposites for aerospace electrical conductors

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Suborbital aerospace, orbital, and lunar power distribution networks are desiring lightweight electrical conductors. Cryogenic hyperconducting aluminum (99.9999%+ pure) is a competitive option to HTS cables at lower temperatures below 20 K due to its high RRR, but hyperconducting aluminum cables require mechanical reinforcement for many applications, reducing current density, and this strengthening must be compatible with aluminum's annealing schedule to prevent impurity diffusion. AlBeMet 162 is a lightweight Al-Be nanocomposite which can be processed like aerospace structural grade aluminum alloys, and like hyperconducting aluminum, does not experience the extreme quench characteristics seen in superconducting composites. In this research, we shall present the electrical conductivity of cryogenic AlBeMet 162, and compare its mass specific engineering current carrying capacity under variable cooling conditions with high RRR copper, hyperconducting aluminum composites, nano carbon metal composites, and a high current density REBCO coated conductor. The electrical conductivity will be examined as a function of magnetic field up to 3 T to examine magnetoresistance and possible anomalous magnetoresistance. The possibility of AlBeMet 162 as a lightweight and low AC loss Litz conductor will also be presented versus the newest low-loss BSCCO and MgB2 composites and high RRR Cu and Al litz. It will be shown that AlBeMet 162H is a superior DC electrical conductor for aerospace in the temperature range of 80 to 150 K and AlBeMet 162H serves a place in the discussion for new low AC-loss conductors.

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