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Particle Reinforced Cu Matrix Conductors for High Field Pulsed Magnets

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The high strength conductors used in pulsed magnets in the US National High Magnetic Field Laboratory (MagLab) are manufactured from Cu matrix composites. One of the composites is made from particle reinforced Cu. The fabrication of these composite conductors requires high deformation strain, which creates high densities of dislocations and reduced particle spacing. Both mechanical strength and electrical conductivity can be predicted from particle spacing and dislocation density. When dislocation density reaches a certain value, the particle size, distribution and shape becomes important to mechanical properties. We studied the particle size, distribution and shape in high-strength conductors with respect to the properties of the conductors. The two most important factors related to above parameters were dislocations near the interface between the particle and the matrix, and the stress concentration near the particles. By engineering these variations, the properties of the conductors can be optimized. This paper reports our understanding of the relationship between critical properties and particle distribution in composite conductors for high field pulsed magnets.
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