Contribution ID: **97** Contribution code: **THU-PO3-617-02** Type: **Poster**

Deformation of Copper Matrix Conductors under Cyclic Loading

Thursday 18 November 2021 10:00 (20 minutes)

High field resistive magnets use Cu matrix composites as conductors because composites conductors have high mechanical strength. The conductors are manufactured by cold deformation that introduces high densities of obstacles to resist dislocation motions. The increased density of these obstacles increases the mechanical strength of the conductors. Under cyclic loading, such as the loading condition in pulsed resistive magnets, the conductors may soften or harden depending on the interaction of the obstacles with the dislocations evolved during the loading. Understanding and predicting the performance of the conductors under cyclic loading helps researchers to predict the life of the coils made from these conductors and make efficient use of them in magnets and to manufacture conductors to meet the requirements of the magnets, particularly when the magnetic stress is above the yield strength of the conductors. The goal of this research is to understand the fatigue properties of selected composite conductors and to relate such properties to types of obstacles. The fatigue test loading is in displacement-controlled mode, which is like what occurs in a state-of-the-art pulsed magnet. This work sheds a light on the correlation between the tensile and fatigue properties in composite conductors by consideration of types of obstacle in composite conductors.

Acknowledgements
This was performed at the National High Magnetic Field Laboratory, USA, which is supported by National Science Foundation Cooperative Agreement [Grant No. NSF DMR-1644779] and the State of Florida, USA.

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Session Classification: THU-PO3-617 Other Components for Magnets