Microstructure-Property Correlations in Superconducting Wires

Peter J. Lee

Applied Superconductivity Center, National High Magnetic Field Laboratory, Tallahassee, Florida 32310, USA

E-mail: lee@asc.magnet.fsu.edu

Abstract – Because of their complexity on length scales from atomic disorder to macroscopic cables, the development of the high-performance superconductors relies on accurate characterization of their micro- and macrostructures. Furthermore, the performance of superconductors is often limited by structural and chemical inhomogeneities, both locally and over long lengths, that provide particular challenges for techniques that often sample only small volumes of material. In this talk, we demonstrate how key developments in our understanding of superconductors wire made possible by combining quantitative microscopic and micro-chemical techniques with detailed characterizations of superconducting properties. As we push our current generation of superconductors towards its limits, we look at the new innovations in microscopy required to understand those limitations and provide us with the information we need to make the next generation of superconductor applications a reality.

Acknowledgment:
This work was supported by the U.S. Department of Energy (Award Numbers DE-SC0012083 and SC0010690) and the State of Florida. A portion of this work was performed at the National High Magnetic Field Laboratory, which is supported by National Science Foundation Cooperative Agreement No. DMR-1157490 (-2017) DMR-1644779 (2018-) and the State of Florida.

Keywords (Index Terms) – Image analysis, superconductors, Nb-Ti, Nb₃Sn, Bi-2212, Niobium, critical current density.