Bi-2223 High-Temperature Superconducting Test Coils for NMR Magnets

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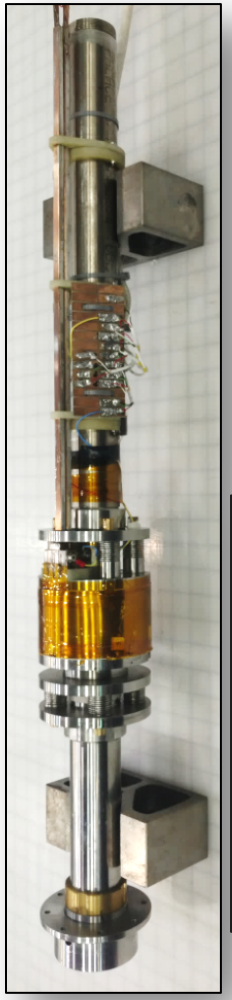
2. **Funding Grants:** G.S. Boebinger (NSF DMR-1157490); W.W Brey, U.P. Trociewitz (NIH R21GM111302)

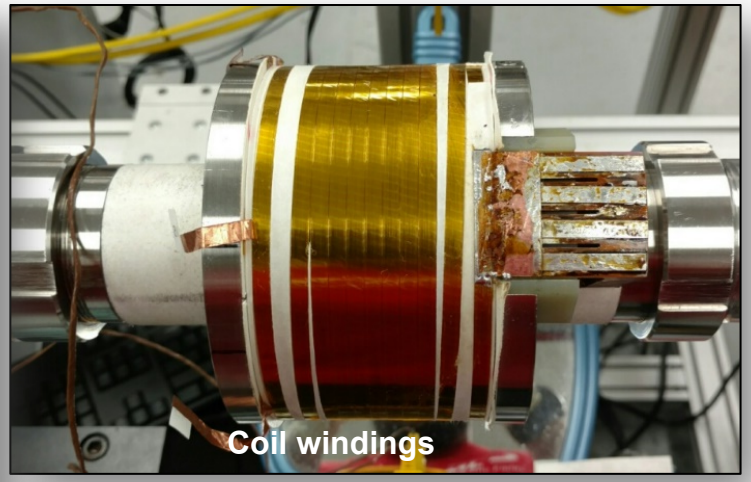
In 2005 the National Academy of Sciences received the final report from its Committee on Opportunities in High Magnetic Fields (COHMAG), which included a challenge to develop a 30 T high-resolution NMR magnet. In response, the MagLab is investigating three high-temperature superconducting (HTS) materials that might be suitable for such an ambitious project. In addition to REBCO tape and Bi-2212 round wire, the MagLab recently tested a reinforced Bi-2223 tape supplied by Sumitomo Electric, designated Type HT-NX. Building on successful early trials with this conductor, an effort to develop technologies for high-field NMR insert coils was initiated.

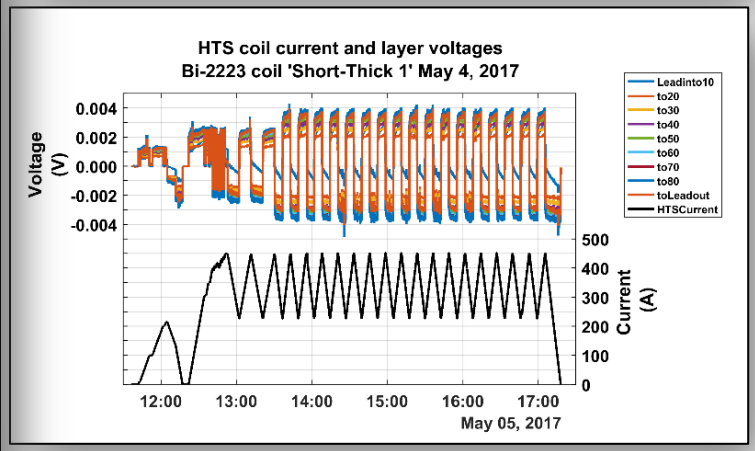
A coil was wound with a 240m length of Type HT-NX conductor. The coil was tested in liquid helium at 4.2 K with a background field of 14T. The coil made an additional 5.5T for a total magnetic field of 19.5T, achieved with a winding current density of 243 A/mm^2. The total strain on the conductor was 0.8%. The coil was cycled to its maximum field 20 times without degradation.

Using the observed values of strain and winding current density as upper limits, a conceptual design was developed using a combination of conventional (low-temperature) superconductors and Bi-2223 coils that should achieve 30.5T in a 1.3 GHz NMR system. Other elements of the technology remain to be addressed, including superconducting splices and notched coil winding to enhance field homogeneity.



Test assembly





Test protocol, including twenty ramps up to peak field

Facilities: Magnet Science and Technology, Applied Superconductivity Center

Citation: W.S. Marshall, M.D. Bird, D.C. Larbalestier, D.M. McRae, P.D. Noyes, A.J. Voran, R.P. Walsh, *IEEE Trans Appl Supercond,* (TBD)