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/mm². 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.

Facilities: Magnet Science and Technology, Applied Superconductivity Center