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Fabrication and Testing of Bi-2223 Insert Coils for High Field NMR Magnets

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In 2005 the Committee on Opportunities in High Magnetic Fields (COHMAG) issued a challenge to develop a 30 T high-resolution NMR magnet. In response, the National High Magnetic Field Laboratory (NHMFL) is investigating all three commercially available high-temperature superconductors (HTS) including REBCO, Bi-2212 and most recently, a reinforced Bi-2223 conductor supplied by Sumitomo Electric, designated Type HT-NX. Recent investigations of Type HT-NX conductor at the NHMFL and by others suggest that operation at stress above 400 MPa, and strain above 0.7% may be feasible. The next steps in our program are reported here, and include fabrication of coils made with conductor piece lengths above 300 meters and testing of those coils at their stress limit at 4.2 K in a 16 Tesla background field. Findings from experience developed during fabrication and testing of these coils are reported. Some details of the coil technology development are presented, including continuous layer winding, splice joints and reduced current density 'notch' windings. For long-term operation, the conductor needs to tolerate repeated cyclic loading. Results from cyclic fatigue measurements of the conductor, and of a test coil are reported, along with estimations made of load and cycle limits.

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