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Present status of Bi-2212 conductor technology

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A critical stage for any conductor technology, especially a wind and react (W&R) technology like Bi-2212 or Nb₃Sn occurs when manufacturing becomes sufficiently mature for magnet use. This is now the case for Bi-2212, the only round wire, twisted, multifilamentary HTS conductor. Bi-2212 had fallen out of favor a decade ago because of its inferior J_c and complex heat treatment for W&R use. In the last 5-7 years, with support from the US DOE-HEP Office, all facets of the conductor technology have now been demonstrated. After losing the legacy powder provider 3 years ago, good powder is now being manufactured by two sources (MetaMateria and nGimat) and one wire company (OST) is making very high critical current density wire in single, multi-km piece lengths on the 10 kg scale. Although the highest J_c values are only presently obtained with overpressure heat treatments at ~ 50 bar, such heat treatments also considerably broaden the heat treatment window, making the heat treatment compatible with full-scale coil manufacture. Insulation schemes fully appropriate for magnets have also been demonstrated. The current density properties are very attractive for use in high fields: for example, J_c(16T, 4.2K) now reaches 4000 A/mm², some 3 times the value possible with Nb₃Sn, while J_c(30T) can reach 2900 A/mm². Hysteretic losses of twisted wires are very comparable to ITER Nb₃Sn wires, much less than for REBCO and Bi-2223 tape conductors. While the Ag matrix has low E and generally low yield stress, reinforced, slightly rectangular conductors with high strength properties are being developed by Solid Materials Solutions. At the MagLab we are applying Bi-2212, Bi-2223 and REBCO to high field magnets with fields >20 T. Our view is that there are clear advantages to using Bi-2212 for high homogeneity magnet applications and those requiring flexible conductor architectures.

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