Development of Bi-2212 Technology for High Field Accelerator Magnets

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Accelerator magnets fabricated using NbTi technology are limited to magnetic fields of about 10 T, due to an upper critical field (H_c2) limitation of 14 T. To surpass this magnetic field restriction, prototype Nb_3Sn magnets are being developed, which have reached a magnetic field of 16 T in a dipole configuration. The present consensus is that the achievable dipole magnetic field using Nb_3Sn technology, is limited to about 17 to 18 T by the material's maximum H_c2 of about 29 T. Therefore, to obtain magnetic fields approaching 20 T and higher, a material is required with a higher H_c2. A realistic candidate for this purpose is Bi-2212, which is available in round wires and sufficient lengths for the fabrication of coils based on Rutherford-type cables. In this article, we describe the design of a small magnet that utilizes Bi-2212 coils, fabricated using the "wind-and-react" method. The program is intended to investigate material specific issues such as cabling performance, oxygen transparent insulator options, heat treatment homogeneity, and more general issues such as the handling of high Lorentz loads and electro-mechanical layout optimizations. Resolving these issues is required for the application of Bi-2212 to surpass the intrinsic magnetic field limitation of Nb_3Sn.