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Quench Behaviour of Bi2Sr2CaCu2O8+x insert coils for high field magnets

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Advances in HTS technology have the potential to enable high field magnets with fields in excess of the maximum obtainable with purely LTS magnets. HTS insert coils may be operated in the bore of a high field LTS magnet, or 'outsert', in order to enhance the overall central field. The HTS inserts are usually operated at the same low temperatures as the LTS coils as this allows a common cooling system to be used and because the critical current density of the HTS is significantly higher at lower temperatures. A remaining barrier to widespread commercial application of HTS insert coils in this space is adequate protection of the HTS coil during quench, where the behaviour of such coils is substantially different from that of LTS coils. Oxford instruments is in collaboration with Bruker-OST and Dresden High Magnetic Field Laboratory to design, build and test a set of HTS insert coils to be tested in the bore of the 19T 150mm LTS magnet currently in operation at Dresden. The coils are wound from B-OST Bi-2212 round wire and are of lengths up to 300mm and diameters up to 125mm. Selected coils have been instrumented for quench initiation and propagation velocity measurements and the relationships between minimum quench energy, quench propagation velocity, operating current and background field have been explored experimentally. Here we discuss the challenges in design, manufacture and test of this set of coils and present experimental results at low and high background field.

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