Contribution ID: **443**

Type: **Poster Presentation**

Effect of Discontinuities and Penetrations on the Shielding Efficacy of High Temperature Superconducting Magnetic Shields

Tuesday, June 30, 2015 9:00 AM (2 hours)

High Temperature Superconducting (HTS) materials have been demonstrated to be suitable for applications in shielding of both DC and AC magnetic fields. Magnetic shielding is required for protecting sensitive instrumentation from external magnetic fields and for preventing the stray magnetic fields produced by high power density equipment from effecting neighboring devices. HTS shields have high current densities at relatively high operating temperatures (40-77 K) and easily be fabricated using commercial HTS conductor. High current densities in HTS materials allow design and fabrication of magnetic shields that are lighter and can be incorporated into the body and skin of high power density devices. HTS shields are particularly attractive for HTS devices because a single cryogenic system can be used for cooling the device and the associated shield. Typical power devices need penetrations for power and signal cabling and the penetrations create discontinuities in HTS shields. Hence it is important to assess the effect of the necessary discontinuities on the efficacy of the shields and the design modifications necessary to accommodate the penetrations. This paper presents the details of the experimental and modelling efforts. Results of the experimental studies at variable amplitude and frequency of the magnetic field and a comparison of the results with those of the models are presented.

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Session Classification: M2PoB - Cryogenic Materials III: Testing and Methods

Track Classification: ICMC-14 - Cryogenic Materials Testing and Methods