MT 26
International Conference on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1337** Type: **Poster Presentation**

Tue-Af-Po2.16-04 [19]: Experimental and Numerical Characterization of the Contactless Self Current Drived HTS Flux Pump

Tuesday 24 September 2019 14:00 (2 hours)

High temperature superconductor (HTS) magnet working in persistent current mode (PCM) shows great potential in improving the efficiency of electrical applications, since it can offer amazing merits in lowering the energy cost and realizing the compact and light weight design of electrical devices. Unfortunately, the lossless PCM HTS magnet is unavailable due to the non-ignorable joint resistance. The compensation of the losses in the HTS magnet is therefore a must. Tranditional current leads powering method causes severe issues to the cryogenic stability and overall efficiency, in virtue of the heat leakage generated by the current leads spaning from cryogenic temperature to room temperature, it would, to some extent, counteract the advantages brought by the HTS magnet technology. To overcome this issue, in this study, in conjunction with the wireless power transfer approach, we have specially designed a contactless self current drived HTS flux pump, by which, a good sealing of the cryostat could be achieved. To validate this idea, a basic prototype has been demonstrated and experimentally investigated. Moreover, a finite element model is implemented based on COMSOL and solved by 2D T-A formulation. The numerical results could be helpful in understanding the mechanism and also be useful in design optimization of the self current drived HTS flux pump. The insights obtained by this work are intended to offer valuable implications for the future exploratations of low loss HTS flux pump.

Key words: HTS magnet, wireless power transfer, HTS flux pump

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Session Classification: Tue-Af-Po2.16 - Power Supplies and Flux Pumps II: Transformers