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## Magnetization Loss of no-insulation high temperature superconductor coil exposed to background fields

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High temperature superconductor (HTS) coil has superior current-carrying ability, and can trap higher magnetic fields, thus shows a promising application on machines with super high power density. Winding coils with bare tapes without any insulation, which is called no-insulation (NI) coil, can significantly enhance the thermal stability and reliability of HTS coils. However, in many applications, such as rotating machines and maglev trains, NI HTS coils are inevitably exposed to a background AC magnetic field. Thus, eddy transport current is induced, which can lead to more magnetization loss in superconductors. This paper provides a detailed study on the magnetization loss of NI coils exposed to AC magnetic fields. A circuit-field critical model is developed for NI HTS coils by coupling an equivalent circuit network model and a finite element method (FEM) T-A formulation model. The network model calculates current distribution, and the FEM model calculates magnetization loss. The influence of transport current, turn-to-turn resistivity, field frequency and amplitude is studied using the model. Results show that coil parameters and working conditions have a significant influence on this external loss. This paper aims to provide valuable knowledge for the development and design of NI HTS machines.

**Primary authors:** XUE, Wenbo (Shanghai Jiao Tong University); LU, Zhen (Shanghai Jiao Tong University); FU, Yutong (1.Shanghai Jiao Tong University 2.Chongqing University); HONG, Zhiyong (Shanghai Jiao Tong University); JIN, Zhijian (Shanghai Jiao Tong University); WANG, Yawei (Shanghai Jiao Tong University)

**Presenter:** XUE, Wenbo (Shanghai Jiao Tong University)

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