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3D Numerical Study on Magnetization Losses in Twisted Soldered-Stacked-Square (3S) HTS wires

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Magnetization loss is an important parameter in the design of high temperature superconductivity (HTS) power devices. In order to reduce magnetization loss, a novel soldered-stacked-square (3S) HTS wire with 1 mm width is firstly proposed and manufactured by our group. In previous work, numerical and experimental results have shown the magnetization loss in the 3S wire is one order smaller than that in the original 4 mm tape with similar critical current under perpendicular magnetic field. However, unexpected large eddy current loss and coupling loss will be generated under parallel field. Therefore, the 3S wire has been twisted in this paper to further reduce the magnetization loss. Firstly, a three-dimensional (3D) numerical model is built for calculating the magnetization loss of the twisted 3S wire. Then, the frequency dependence and structure dependence of the twisted 3S wires are also been evaluated. Finally, the magnetization loss in the twisted 3S wire are compared with that in the original 3S wire to verify whether twisting could reduce the magnetization loss.

Keywords: 3D numerical model, 3S wires with 1 mm width, magnetization loss, twisting