

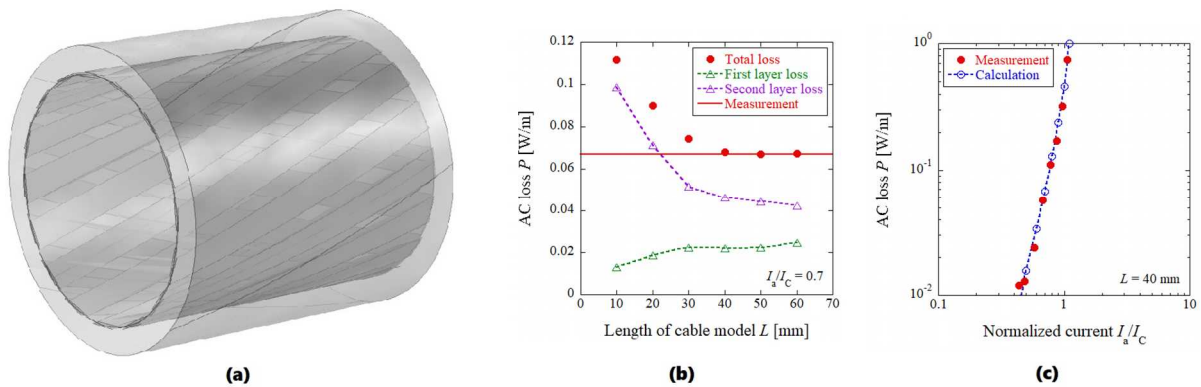
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Numerical Study on AC Loss Properties of Two-Layer REBCO Power Cable by 3D Finite Element Method

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This study investigates the loss properties in a two superconducting-layer REBCO power cable fabricated by researchers at Furukawa Electric Co. Ltd. The losses were calculated by a three-dimensional finite element method (3D FEM) using COMSOL, which is based on H formulation without the thin-strip approximation of the superconductor. Fig. (a) shows the cable model which has the helical pitches of first layer and second layer are 340 mm (S-direction) and 280 mm (Z-direction), respectively. Fig. (b) plots the losses as functions of length of the cable model, fixing the normalized current $I_a/I_c = 0.7$. Here, I_a and I_c are transport current and critical current of the cable. As the length of cable model L is too short, a layer current of the outer layer is calculated as high, then a layer loss of the outer layer is obtained as high. Therefore, a total loss becomes large in comparing with a measurement. To get an accurate calculation, it is found that the L should be longer than 40 mm in this cable. Fig. (c) plots the total losses of the cable as functions of I_a/I_c , fixing $L = 40$ mm. As can be seen, the calculated value is almost equal to the measurement.



Keywords: AC loss, REBCO power cable, 3D FEM, EC model