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Evaluation of critical currents in Rutherford cables made of quasi-isotropic strands

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Applications for coated conductors, such as fusion magnets, power transmission and generator windings, require high current-carrying capacity. This requirement can be fulfilled by various cable concepts using commercial lengths of REBCO coated conductors with high current-carrying properties, such as Rutherford cables. In the past few years, our group has successfully developed Quasi-isotropic strands (QI-S) which consisit of 72 symmetrically assembled by second generation (2G) high temperature superconducting (HTS) conductors that are attractive for low temperature high field magnet applications.In this work, we investigated the critical current evaluation process of Rutherford cables made of quasi-isotropic strands.The Rutherford cable prototype was determined, and the critical current of the dummy cable was calculated by the finite element method (FEM)based on a self-consistent model, and then measured experimentally.Their conclusions are in general agreement. Then,the method was extended to the evaluation calculation of the critical current of the fully superconducting Rutherford cable. Finally, the critical current values of Rutherford cables made of quasi-isotropic strands were obtained by simulation calculations, which will be useful for future experimental validation and engineering applications.

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