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Numerical and Experimental Evaluations of the Quench Detection Performance of NbTi/YBCO Hybrid Tape

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Quench detection is important for the application of the high-temperature superconducting (HTS) tape, especially REBCO tape. However, there is a serious issue that voltage drop is too small to detect quench due to the small normal zone propagation velocity (NZPV) in HTS. To address this issue, we have proposed a quench detectable LTS/HTS hybrid tape consisting of the low-temperature superconducting (LTS) wire used for quench detection and the REBCO tape used for current transportation. In our previous report [1], we conducted the numerical simulation and experiment with the prototype of the hybrid tape. Then, the validity of the analysis code for the hybrid tape and the possibility that voltage occurred over the LTS wire before HTS tape burned out were demonstrated. However, NZPV and detectable voltage in the NbTi were small for the quench detection due to its copper stabilizer with low resistivity and its large critical current. According to the numerical simulations, this issue would be overcome by decreasing copper ratio or critical current of the NbTi wire. Hence, the purpose of this study is to clarify the influences of copper ratio or critical current of the NbTi wire on the quench detection performance of the hybrid tape. We made the numerical model of the hybrid tape where thin pure NbTi wire was fixed on the YBCO tape with epoxy. The simulation showed that 1 V scale voltage occurred over the NbTi wire before YBCO tape burned out when 0.1 A was applied to the NbTi wire, respectively. Details of the numerical simulation and experiment will be presented at the conference.
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[1] S. Hasegawa, et al. Abstracts of 1st Asian ICMC-CSSJ 50th Anniversary Conference (2016), pp. 6

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