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M1Or1A-04: Jc measurement and current sharing in REBCO coated conductor with Ni stabilizer.

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REBCO coated conductors are increasingly of interest for high field magnets applications such as high field insert magnets for particle accelerator and fusion magnets. One promising design for such applications is the no-insulation magnet which utilizes the self-protecting mechanism of current sharing between REBCO tapes to provide better stability and quench protection to the coil. Our previous study has demonstrated that current sharing between REBCO tapes can be assisted by modifying the contact surface properties, inter-strand electrical contact resistance (ICR) and inter-strand thermal resistance (ITR), and one of the most effective methods through our study is Ni-plating that can give an inter-strand contact efficiency, η ($\eta = \text{ICR}_{\text{contact area}}$), of $2.7 \mu\Omega\text{cm}^2$. In addition, some novel designs of REBCO coated conductor tape/cable, for example STAR cable and tape with asymmetric Cu stabilizer, have suggested less percentage of Cu is included in the conductor structures, suggesting a less significant role of Cu in the conductor. Hence, in this study, we proposed to replace the Cu stabilizer with Ni to enhance current sharing between conductors. We used a Gamry cell to perform the electrolytic process of Cu removal and Ni plating. Then Jc of the Ni-plated tape was tested at 77 K under self-field and at 4.2 K under a background field ranging from 1 T to 10 T. The results were compared to the original tape. Then FEM analyses were performed with COMSOL Multiphysics to study the current sharing behavior in both the Ni-plated tape and the original tape to figure out how much improvement could be achieved by replacing the Cu stabilizer with Ni stabilizer.

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