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Current sharing properties of REBCO superconducting parallel conductors wound into a coil

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Operating current of large-scale superconducting magnets needs to be enhanced up to several thousand to several tens thousand amps from the viewpoint of magnet protection in relation to the consumption of stored energy by an external resistor. On the other hand, superconducting magnets for MRI need the uniformity of produced magnetic field within ppm order in time and space. We proposed the configuration of parallel conductors to enhance the current capacity of REBCO superconducting thin tapes. The constituent tapes should be insulated and transposed so as to be inductively equivalent for the even current sharing and low ac loss. However it is usual that the critical current, Ic, and n-value of currently developed REBCO superconducting tapes disperse. We demonstrated in the previous study that the current sharing among the tapes of parallel conductors was influenced by the difference in Ic and n-value even if the tapes were suitably transposed and inductively balanced. Just a little unbalance of current sharing also affects the uniformity of produced magnetic field. In the previous study it was assumed that the applied magnetic field to the parallel conductors wound into a coil was uniform. However, in an actual situation, parallel conductors are subject to the self magnetic field of the respective coils and then the applied magnetic field varies in space. So, in this study, current sharing properties when 3-strand parallel conductors with the dispersions of Ic and n-value are wound into a coil are investigated taking into account of magnetic field distribution inside the coil with a numerical simulation for an equivalent circuit. Here the I-V characteristics of each tape are expressed by n-power law. In this conference, we will present the details of obtained results.

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