Over-Current Characteristics of the REBCO Coated Conductors with Inhomogeneous Critical Current and Index Number

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Abstract: Repetitive quench tests and over-current tests were performed on REBCO-coated conductors to investigate the effects of the inhomogeneous critical current and $n$-value on their degradation and permanent damage. Based on the repetitive quench tests, the critical current of the samples degraded from 93 A to 52 A after the 16th repetition. Local degradation of the critical current was observed in the sections with high $n$-values, while the sections with low critical current values remained intact. Results from the over-current test showed that all REBCO-coated conductor samples burned out at the section with the highest $n$-value, at which Joule heat energy was easily initiated to result in excessive accumulation. Hence, the $n$-value of the REBCO-coated conductor can be one of the essential factors leading to permanent damage of the coated conductor in over-current conditions, as it increases the voltage and Joule heat generation. Overall, the results of this study suggest that the inhomogeneity of the $n$-value should be considered when designing superconducting devices operated in over-current conditions, such as the superconducting fault current limiters.

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