

Quench Properties of Superconducting Fault Current Limiting Elements Connected in Parallel and Series

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We investigated the quench properties of superconducting fault current limiters (SFCLs) that consisted of current limiting elements connected in parallel and series. It was carried out as an effort to scale up the current and the voltage capacity of SFCLs. Current limiting elements were based on $\text{YBa}_2\text{Cu}_3\text{O}_7$ films coated insitu with a gold layer, and fabricated by patterning the films into 2 mm wide and 42 cm long meander lines by photolithography. The limiters were tested with simulated AC fault currents. In the circuit where the limiting elements were connected in parallel, initially the current was divided unequally into the branches of parallel connection due to unequal resistances of the branches. However, once quench started in the limiting elements, the current was observed to oscillate between the branches and then equally distributed among the branches, or equivalently, the elements quenched simultaneously. The oscillation amplitude decreased as the source voltage was increased: the oscillation was the most prominent near the quench current. Simultaneous quench was also observed when the limiting elements were connected in a suitable combination of parallel and series. The observed oscillation and the consequent simultaneous quench was understood in terms of the quench start and development in the limiting elements.

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