Resistance of Superconducting Fault Current Limiters under Fault Conditions

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We investigated the resistance development in resistive superconducting fault current limiters (SFCLs) based on $YBa_2Cu_3O_7$ (YBCO) thin films during the entire period of faults. Investigation of resistance during the entire period of faults is important in predicting the current limitation behavior of SFCLs. SFCL samples were fabricated by patterning 0.3 μm thick YBCO films coated with 0.2 μm thick gold layers into lines of various forms. The SFCLs were subjected to simulated AC fault current for resistance measurements. They were immersed in liquid nitrogen during the experiment. Experimental results were analyzed quantitatively with the concept of heat transfer within the SFCLs and to the surrounding liquid nitrogen. The entire period of faults was divided into three regions: flux-flow region, region prior to quench completion, and region after quench completion. This analysis was focused on upgrading previous works and on joining three regions seamlessly. Simulation formulas were derived for each region. The results showed that they could explain resistance data for wide ranges of samples. The formulas were used in predicting current limitation behaviors of various SFCLs.
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