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Current transport characteristics of a superconducting joint between REBCO conductors made by a novel method

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The superconducting joint technology used for high-temperature superconductors (HTS) is key for realizing persistent operation of HTS magnets. Recently we have succeeded in developing a superconducting joint between REBCO conductors using a polycrystalline intermediate, which has a critical current (Ic) of >100 A at 77 K [1]; A REBCO micro-polycrystalline intermediate was prepared on the surface of the REBCO layer of a conductor and it was transformed into large poly-crystals or single-like crystals as a joint.
We measured the persistent field decay of a small double pancake coil, terminated with this type of joint, at 77 K in a self-field with an operating current of ~10 A (~14% of the calculated coil Ic) for three days. The field decay rate decreased exponentially for the first several hours and then logarithmically, corresponding to a characteristic resistance between ~3×10^-12 to ~5×10^-13 Ω. The logarithmic decay implies that the joint resistance was not constant and might depend on flux creep. The effect of screening current relaxation on field decay and the coil load factor dependence will be investigated.
We also measured Ic-B characteristics of the joint in the temperature range from 4 K to 77 K in a field of <10 T. In a self-field, Ic at 4 K was ~7 times higher than that at 77 K. At 4 K, Ic steeply reduced with the field of <1 T and gradually decreased in the range of 1-10 T. The result shows that the joint structure includes a superconducting current path which is weak against a magnetic field. The superconducting current mechanism through the joint device will be discussed based on SEM and TEM observations.
[1] T. Nagaishi et al., Presented at 1st Asian ICMC and CSSJ 50th Anniversary Conference, 3A-p02, Kanazawa, Nov.7-10(2016)
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