Improvement of in-field characteristics of REBCO coated conductors

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Many of applications using REBCO coated conductors are expected to be operated under magnetic fields. Competing against other materials such as BSCCO, coated conductors need to have higher in-field properties. Introduction of artificial pinning centers (APC) is a simple and effective approach to improve in-field Jc values. PLD (Pulsed Laser Deposition) and TFA-MOD (Metal Organic Deposition using Trifluoroacetates) have been developed in our group.

In the case of PLD, fine nanorods (5-10 nm in diameter) were introduced within REBCO grains and effectively worked as APCs. A high in-field I_c value of 141 A/cm-w @77K, 3T was realized by using a new materials combination of EuBCO and BaHfO3 (BHO). The thickness dependence of the in-field Ic showed higher linearity than that of the previous combination of GdBCO and BHO, especially at the thick film (3-4 microns). A 100m long EuBCO+BHO wire was successfully fabricated to have about 100 A/cm-w @77K, 3T.

The APCs were dispersed into MOD derived REBCO as well to improve in-field characteristics. Adding Zr-salts into materials solution, BaZrO3 (BZO) nano particles formed prior to REBCO growth and were entrapped into REBCO grains. The heating profile for conversion was improved; the precursor films were held at around 575 C for several hours before heating up to REBCO growth temperature (around 780 C). We have named the treatment as the intermediate heat treatment (IHT). IHT made BZO size smaller (20-30 nm in diameter), resulting in high in-field characteristics (68 A/cm-w @77K, 3T).

The crystal growth mechanism of PLD and MOD derived REBCO+APCs will be discussed in the presentation.

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