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Tue-Mo-Po2.10-07 [79]: High-field electrical transport properties of THEVA GdBa2Cu3O7 coated conductors

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High-temperature superconducting (HTS) tapes are promising materials for developing high-field magnets for fields exceeding 30 T. Therefore, it is important to characterize their properties at high fields, in particular, the critical current, I_c. One of the promising types of HTS tape is produced by THEVA where the architecture of the tape is unique and simple. Nowadays, these tapes show self-field I_c at 77 K of about 600 A/cm-width, among the highest reported. Moreover, since the microstructure of GdBCO in these tapes has a tilted orientation, maximum I_c can be achieved around 60° from the normal direction. However, the transport properties at low temperatures are not easily available due to the large current requirements. In this work, the field and angle dependence of the transport I_c at 4.2 K and magnetic fields up to 29 T is measured for the first time.
A 4 mm-wide THEVA Pro-Line HTS tape and pinning-improved tapes are characterized. The standard tape has a self-field I_c of 240 A at 77 K, and a similar value is obtained at 4.2 K and 15 T for $B \parallel c$. For $B \perp$tape, I_c is 180 A at 29 T and about 460 A at 5 T. These are already competitive results when compared to the present high values at 4.2 K of 4-mm wide tapes. The parameter α based on the field dependence of I_c given by $I_c(B) \propto B^{-\alpha}$, is around 0.5 within the angular range of -45° to 50° and decreases to 0.3 for $B \parallel ab$. The pinning force per unit length, F_p continuously increases up to 29 T, and no maximum was observed for all angles. With the good in-field properties obtained in the standard THEVA tape, further investigations on tapes with additional pinning centers are conducted to explore how I_c would further improve at very high fields.

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