Highlights

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Transport current and magnetization of Bi-2212 wires above liquid Helium temperature for cryogen-free applications

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Since the discovery of high temperature superconductors, a possible cryogen-free scenario has always been wished. Nowadays, liquid Helium is running out, and it is likely that the cooling by will be a large part of the costs of any superconducting system. Bi-2212 wires at temperature higher than 4.2 K still show a very high irreversibility field and thus a deep investigation of their properties in such a range of temperature is very useful to assess its applicability. In the manuscript we reported electrical transport and magnetic properties characterization at variable temperature and magnetic field on our "GDG—processed" wires [1] together with a well-described original approach to calculate the irreversibility field H_{irr}; this characterization is useful to fill a gap in the literature on this superconductor. The paper can be summarized drawing the following conclusions: • Bi-2212 wire has been shown to be suitable for high magnetic field applications at 10 K, having good stability of J_C and an irreversibility field higher than 70 T. These properties open a wide window of applicability in the temperature—field diagram. Our original wires processed at 1 bar show at 10 K a J_E = 500 A/mm^2 at 7 T promising to be in line with the application requirements also at high field;
• The two main Bi-2212 powders used up to now to fabricate P.I.T. wires—Nexans and Engi-Mat—led to very different transport properties of the conductors, being J_C of Engi-Mat conductors about twice higher than Nexans ones. Our analysis finds no different pinning properties below 20 K and, therefore, the reasons for their different effect have to be found in other aspects such as connectivity and grain boundaries cleanliness; • An original and consistent approaching method has been proposed to calculate the H_{irr} which overcomes the approximation brought by the Kramer plot. We think that such a method might be used as a reference for future works and analysis.

[1] Leveratto, A., Supercond. Sci. Technol. 29, 4 (2016)

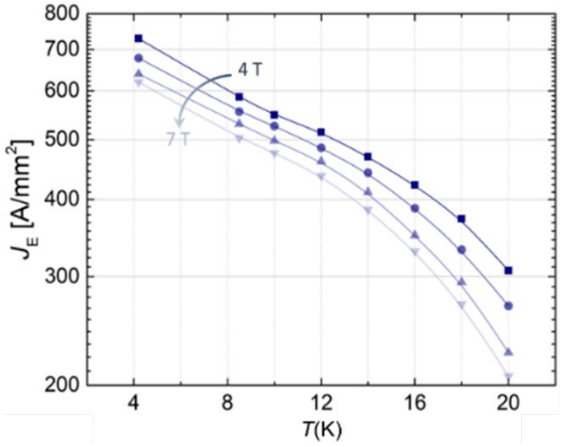

Fig. 1: J_E (T) SPIN36engimat at different magnetic fields.

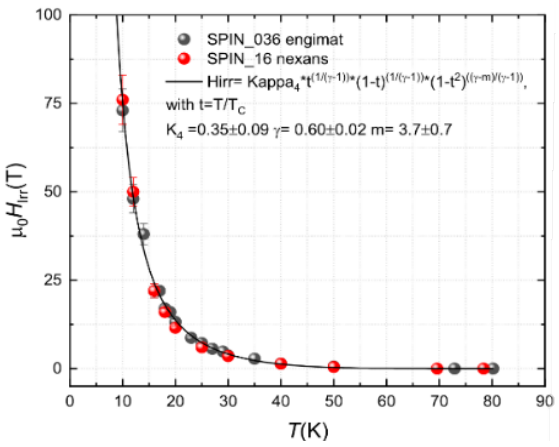

Fig. 2: H_{irr}(T) of both SPIN36engimat (black circles) and SPIN16nexans (red cycles).