Highlights

RESEARCH AREA 1 - **Superconductors and Innovative materials for Energy and Environment** - 2022

"Investigation of transport mechanisms induced by filament-coupling bridges-network in Bi-2212 wires"

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Bi-2212/Ag wires exhibit a unique feature: a network of grain bridges within the Ag matrix during the partial-melt heat treatment process. While these bridges enhance current distribution and critical current density, they also represent a strong electrical coupling between filaments themselves. This coupling amplifies AC losses, a significant drawback for applications like DC magnets and power transmission. In this work, through transport and magnetic measurements and their comparison, we study the behavior of these bridges as a function of applied magnetic field (up to 7 T) and temperature (up to 60 K) and the implications they have on the electrical coupling. The experiment has been performed on multifilamentary wires prepared by Groove-Die-Groove (GDG) Powder-In-Tube process. The reported results show that the effective length scale on which the filaments are coupled is dependent on the field and temperature, passing from the filaments-bundle diameter regime at low field and temperature to single filament diameter regime at high field and temperature. The proposed combination of dc and magnetic *JC* measurements will be useful in the identification of bridges behavior and thus our findings can be of support for future works on AC losses evaluation and magnet design.

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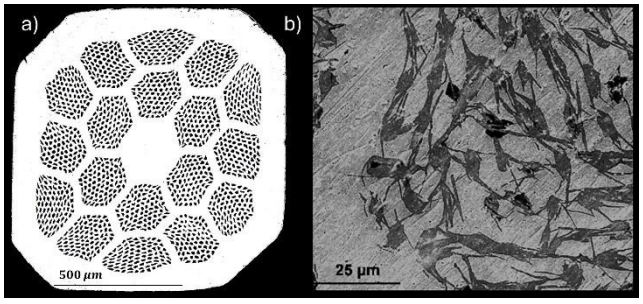
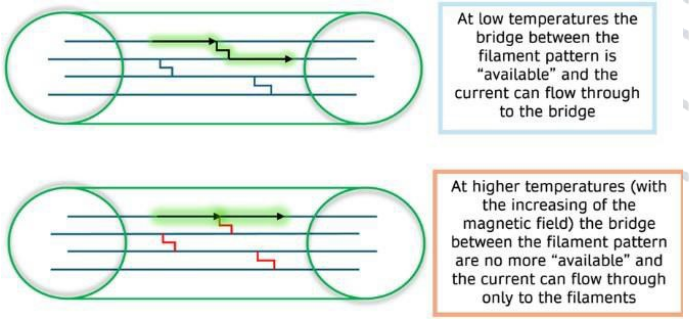


Fig. 1: optical image of the green wire (a) and SEM micrograph of the filaments connection induced by the growth of Bi-2212 across the Ag-matrix after the heat treatment.



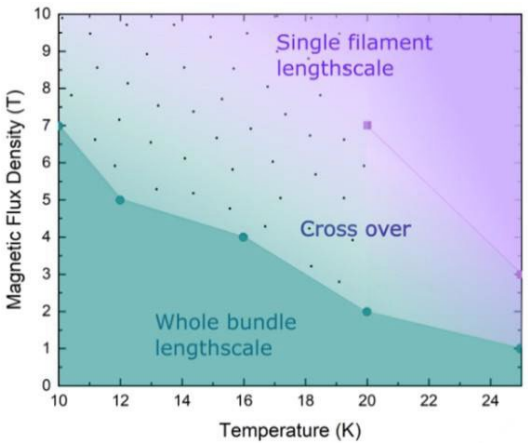


Fig. 2: a) Explanation sketch of the two different transport regimes (whole bundle or single filament); b) in the space *temperature–magnetic field* we observe, through the comparison between magnetic and transport measurements, the behavior reported in the diagram where, in function of T and B, one can decide and choose the preferred working regime.