Heat Treatment Optimization Studies on PIT Nb₃Sn Strand for the NED Project

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Abstract — For the Next European Dipole (NED) program, a Powder-In-Tube (PIT) strand was successfully developed by SMI. This high-performance Nb₃Sn strand presents a non-copper critical current density of ~ 2500 A/mm² at 12 T applied field and 4.2 K and a filament diameter around 50 µm. Extensive heat treatment optimization studies were performed in order to maximize both critical current and RRR, with a plateau temperature down to 625°C and duration up to 400 hours. It appears that a critical current enhancement of ~ 10 % can be achieved for a reaction schedule of 320 hours at 625°C with non-copper critical current density respectively exceeding 2700 and 1500 A/mm² at 12 and 15 T (4.2 K). Thanks to this modified heat treatment, this strand completely fulfills the NED stringent specification.

Index Terms—Niobium compounds, superconducting wires, low-temperature superconductors, superconducting materials measurements.

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