Review of Design Aspects for High Current Nb_3Sn Conductors

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Abstract - Cabled conductors based on Nb3Sn technology with operating current in the range of 20 kA and above are mainly restricted to fusion magnets and high field facilities. The experience of last decade has dramatically shown that, opposite to the NbTi conductors, straight scaling laws from the strands properties are not adequate for a reliable conductor design. Reversible and irreversible degradation heavily affects the conductor performance and frustrates the outstanding progress on the high current density Nb3Sn strands. The evidence of performance degradation upon electromagnetic and thermal cycles is a further concern for a reliable and effective design. The knowledge to improve the design of Nb3Sn high current conductors is gained in little steps, collecting over a longer period the results from different projects, including the test of short length conductors and model coils. This review highlights the key results from the last decade with the aim of drawing relevant conclusions about the impact of the individual layout and technology parameters on the performance degradation, including the strand technology, the cabling pattern, the void fraction, the aspect ratio, the electromagnetic load, the longitudinal strain and the magnet technology.

Index Terms - Superconducting cables, Superconducting filaments and wires

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