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Wed-Af-Or14-02: Reduced strain/stress sensitivity of the critical current of Nb₃Sn conductors

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It was found that arranging filaments in a multifilament Nb₃Sn conductor under a specific angle or twist pitch length, the strain sensitivity of the critical current can be removed. The physical reason is that at such an angle the distortion of the Nb₃Sn crystallographic unit cell, which is responsible for the reduction of the critical current under strain, is zero and independent of the applied uniaxial strain/stress. This is the result of a study of the Nb₃Sn unit cell of Nb₃Sn conductors under different axial strains carried out at the European Synchrotron Radiation Facility (ESRF) at Grenoble and modelling the distortion as a function of applied strain and angle with respect to the wire axis. In the following a Nb₃Sn multifilamentary wire (OD = 1.45 mm) with different twist pitch lengths down to 5 mm were manufactured by Bruker EAS and the critical current versus strain behaviour measured at 19 T @ 4.2 K (University of Geneva). The wire with 5 mm twist pitch shows the appearance of a plateau between 0.1% and 0.6% applied strain with an almost constant critical current, as predicted by modelling. Wires with longer twist pitch length behave as usual and as known from literature. It remains the challenge for wire manufacturers to obtain short twist pitch lengths without damaging filaments.

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