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Effect of transverse stress applied during reaction heat treatment on the stiffness of Nb₃Sn Rutherford cable stacks

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The stress-strain behaviour of the Nb₃Sn conductor blocks of the superconducting coils for the Future Circular Collider (FCC) magnets need to be known in order to predict the stress state distribution in the coils during magnet assembly and operation. The stress-strain behaviour of reacted and impregnated 11 T Rutherford cable stacks has been determined using a dedicated set-up with an extensometer for strain measurements. The set-up was commissioned using reference samples with known mechanical properties. The effect of the sample geometry (cylindrical vs cubic) and sample size on the stiffness has been measured and calculated by finite element simulations.

The investigation of a possible correlation between applied compression during the reaction heat treatment and measured stiffness of the impregnated stack measured in transversal, radial and axial direction have been performed. As expected, the stiffness of the Rutherford cable stack increases with increasing compression during the reaction heat treatment.

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