Contribution ID: **183** Type: **Invited Oral Presentation**

[Invited] The origin of strain sensitivity in Nb3Sn

Tuesday, 30 June 2015 11:00 (30 minutes)

Externally applied strain affects the superconducting properties of Nb3Sn in a detrimental way. This is an important design issue in high-magnetic-field applications utilizing Nb3Sn technology where distortion due to Lorentz forces and differential thermal contraction is unavoidable.
An overview is given of how the critical current density of Nb3Sn is affected by temperature, magnetic field and strain. Subsequently, it is demonstrated that the large strain sensitivity in Nb3Sn is a direct result of a strain-induced distortion of the niobium chains. Ab-initio calculations are combined with microscopic theory to determine how this distortion affects the superconducting properties and normal state resistivity in quantitative terms, and the results are validated with experimental observations. The same model is then used to explain the different degrees of strain sensitivity between Nb3Sn, Nb3Al, Nb and NbTi.
Understanding the underlying mechanisms that determine the (strain-dependent) superconducting properties of Nb3Sn is an important step forward in maximizing the performance of Nb3Sn technology in high field applications.

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Session Classification: M2OrA - Superconductor Materials III: Nb3Sn

Track Classification: ICMC-01 - NbTi/Nb3Sn/A15 Processing and Properties