Contribution ID: **600** Type: **Poster**

Fri-Af-Po.11-01: Characterizing Mechanical and Thermal Effects of Solder Voids in Stacked-tape HTC Coils and Cables for Fusion

Friday 4 July 2025 14:00 (2 hours)

High-field magnet designs for fusion increasingly utilize stacked high-temperature superconducting (HTS) tapes embedded in a solder matrix through vacuum impregnation. The extreme mechanical loads placed upon the tapes as well as multiple sources of heating within a fusion machine make voids within the solder matrix represent a critical source of uncertainty. If not properly accounted for during design, these voids could lead to unexpected performance degradation under operational stresses and diminished thermal stability.

This study integrates experimental and simulation-based approaches to quantify the effects of solder voids on key performance parameters, including critical current, n-value, electrical resistance, and thermal flux. Through mechanical testing and finite element simulations, we identify mechanisms through which voids exacerbate damage onset under Lorentz forces. Thermal analysis reveals the influence of voids on hot spot propagation, demonstrating how localized voids can intensify thermal instability. By elucidating the impact of void size, shape, and distribution on soldered HTS stacks, this work provides actionable insights to improve the design, manufacturing, and quality control processes for solder impregnated stacked-tape conductors for use in fusion magnets.

Author: MOORE, Peter S. (Tufts University)

Co-authors: BIRD, Claudia (Tufts University); CHIESA, Luisa (Tufts University)

Presenter: MOORE, Peter S. (Tufts University)

Session Classification: Fri-Af-Po.11 - Experiments and Test for Fusion Magnets