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M3Or4B-01: [Invited] Quality assurance testing of materials for the 40 T superconducting magnet project

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High quality materials are essential to the success of large magnet projects. National High Magnetic Field Laboratory (NHMFL) has been funded by the US National Science Foundation to design a 40 T superconducting magnet which uses REBCO coated conductor tapes for the insert coil winding co-wound with copper and stainless-steel tapes. Characterization and incoming quality assurance (QA) testing for these materials are obviously critical to the success of test coils in this project.

The critical current (I_c) of commercial REBCO tapes is typically characterized by the vendors at 77 K. But I_c at 4.2 K, the temperature the 40 T magnet is designed for, and many other important properties are not tested by the vendors. Therefore, we carry out a comprehensive QA sub-project. The following tests are performed on each spool of the received tapes: transport I_c at 4.2 K in magnetic field up to 15 T; I_c versus field angle using torque magnetometry at 4.2 K up to 15 T; residual-resistance-ratio (RRR) of copper stabilizer; thickness profile across tape width; REBCO ab plane tilt angle; peel strength; and lap joint resistivity at 77 K. In addition, the electromagnetic property such as I_c versus longitudinal tensile strain, and tensile fatigue properties are measured every 10 spools at 77 K. The mechanical properties of copper and stainless-steel co-wind tapes are characterized as well.

In this talk, we present results from these comprehensive QA tests of over 150 spools of REBCO tapes (total of >20 km). Important experiences of carrying out these incoming QA measurements will be shared.

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