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Fri-Mo-Po.01-02: [Invited] 15 T in-field REBCO coil tests to discuss two intriguing, controversial issues for higher field generation: the use of higher conductors and the importance of the misorientation of the REBCO layer's c -axis to the tape plane

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The Small Test Coil (STC) magnet testbed using a REBCO coil and a 15 T background magnet was designed to answer key issues in high-field, high-stress superconducting magnet technology. Recent STC revisited screening current stress (SCS) and subsequent conductor damage issues, and concluded the limit of the full elastic deformation assumptions for accurate SCS calculations and conductor damage evaluations of high-field, high-stress coils, thus proposing the consideration of elastic-plastic deformation regimes. We are now addressing two intriguing, controversial issues for higher field generation using the same experimental settings of the recent test. The first one is that higher critical current density (J_c) conductors are necessary to generate higher fields, but ironically, such higher J_c results in more conductor damage due to large SCS, which can greatly reduce operational stability. The next one is SCS induction depending on the REBCO layer's c -axis orientation. For instance, if the c -axis points inward towards the magnetic field center, then J_c decreases depending on the field condition, but the penetration depth (w_{pen}) of screening current increases due to the penetrating component increases. In contrast, if it points outward towards the center, then J_c increases but the depth decreases. Since the magnetic force correlates to $J_c \times w_{pen}$, we do not know what is better orientation at present yet. We designed, fabricated, and tested several coils having the same coil dimensions, coil charge scenarios, and background fields, but different J_c and the c -axis orientation. This presentation will provide experiment details, test results, and comparison results.

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