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Fri-Mo-Or27-01: Current Status and Challenges in No-Insulation HTS Magnet Technology

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It was a milestone to generate a record-high DC field of 45.5 T by use of a 14.4 T no-insulation (NI) REBCO insert, named Little Big Coil (LBC), operated in a 31.1 T resistive background magnet by the National High Magnetic Field Laboratory. The engineering current density of the NI REBCO insert was ~ 1200 A/mm² at 45.5 T, nearly 6 times larger than that of the conventional insulated HTS coils, ~ 200 A/mm², yet LBC did not experience electric burn-out upon a quench. However, it did experience various patterns of mechanical damages, which delivered us some insights to deepen our understanding of causes and mechanisms on the mechanical damages in ultra-high field HTS magnets. In this paper, we first summarize the state-of-the-art NI HTS magnet technology and its widespread applications beyond the high field laboratory magnets. Then we will discuss about recent lessons that we learned regarding the potential causes and the mechanisms on the mechanical damages in high field HTS magnets, not limited to NI.

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