

## Robust REBCO Coil Structure for High Field Cryogen-free Superconducting Magnet

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**Abstract** – We have achieved 25.1 T with the 25T cryogen-free superconducting magnet (CSM), which consists of the Bi2223 insert, high strength CuNb/Nb<sub>3</sub>Sn and NbTi Rutherford cable outserts [1, 2]. As a next step, the upgrade of 25T-CSM with replacing the present Bi2223 insert to the REBCO one is ongoing at High Field Laboratory for Superconducting Materials, IMR, Tohoku University [3]. This is an R&D study for future high field cryogen-free superconducting magnet beyond 30 T. In order to realize a robust REBCO high field insert, we adopt the two-ply REBCO tape and a fluoride coated polyimide tape co-winding, and the epoxy impregnation. We confirmed more than 90% of critical current performance of the two-ply REBCO coil with a damage at 50 K, suggesting that the two-ply REBCO winding can improve the coil reliability. In addition, we found that the robust structure can optimize the stress distribution in the coil and reduce the screening current induced stress drastically because of the restriction at both edges of windings by the epoxy impregnation with thin FRP sheets [4, 5].

[1] S. Awaji et al., Supercond. Sci. Technol. 30 (2017) 065001.

[2] S. Awaji et al., to be presented at MT27, 2021.

[3] S. Awaji et al., IEEE TAS, 31 (2021) 4300105.

[4] K. Takahashi et al., IEEE TAS, 31 (2021) 4602305.

[5] A. Badel et al., M3Or4B-02, CEC/ICMC21, 2021 on-line.

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