High field Superconducting Magnet Development with HTS - Lessons Learned

S. Awaji[1], K. Takahashi[1], A. Badel[2], A. Zampa[1], T. Okada[1], and Y. Tsuchiya[1]

[1]High Field Laboratory for Superconducting Materials, Tohoku University, Japan
[2]Neel Institute, Grenoble, France

E-mail: awaji@tohoku.ac.jp

***Abstract* – Since practical high temperature superconducting (HTS) tapes/wires are now commercially available, various HTS applications are being developed recently. Many of them are based on HTS magnets. In the meanwhile, high field superconducting magnets beyond 20 T with HTS are also being developed worldwide. We have developed high field cryogen-free superconducting magnets (CSMs) with HTS for long time. 25T-CSM, consisting of 14 T low temperature superconducting outsert and 11T Bi2223 insert, is operated for more than 7 years as a user magnet at HFLSM. In addition, a 33 T-CSM is under construction now. The 33T-CSM consists of a 19T REBCO insert and 14 T LTS outsert. For 7 years operation of the 25T-CSM, we met some issues related to the coil stiffness and leaned HTS magnet technologies. Those are about the Bi2223 high field insert but are also important for REBCO one. In addition, REBCO tapes have some issues on delamination against a perpendicular force and local Jc drops. Actually, we have many experiences in the degradation of REBCO coils. To overcome those issues, we proposed a robust coil concept, which consists of two REBCO tape co-winding and an edge impregnation. In the presentation, strategies of practical high field HTS magnet developments will be discussed based on lessons learned from previous R&D studies.**

***Keywords (Index Terms)* – Cryogen-free superconducting magnet, high magnetic field, REBCO, Bi2223, high strength Nb_3Sn**

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