

Update on the Developments of Coated Conductor High Field Magnets in Japan

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Abstract — It is well known that the RE123 coated conductor with a buffered Hastelloy is one of promising superconducting tapes for high field magnets because of its high in-field J_c and strong mechanical strength. In fact, some important projects on high field superconducting magnets using the coated conductors are ongoing recently. However, 1) Degradation due to delamination, 2) Quench protection against hotspot and 3) Reduction of magnetic field quality due to magnetization current are also well known as important issues of the RE123 coated conductor coils. In particular, the delamination problem is most serious to prepare a coil but was recently almost overcome by a separation of windings and the use of a brittle resin. After many R&D coil tests, we succeeded in the generation of 10 T using a Gd123 coil under a cryogen-free condition without a background field for the 25 T cryogen-free superconducting magnet [1]. In this case, thanks to the all turn separation technique, 56 epoxy impregnated Gd123 single pancakes were successfully prepared without any degradation and were stacked into the Gd123 insert coil. However, the Gd123 insert quenched at the combination test under the background field of 14 T due to the outer low temperature superconducting magnets. From the operation tests, the quench behaviors, the magnetization current effects and ac losses of the Gd123 coils were obtained in high magnetic fields up to 24 T. Those are important for further developments of the coated conductor magnets. In addition, high field magnets for research, NMR and MRI were under development recently in Japan. Recent updates of high field magnet developments using RE123 coated conductors in Japan will be also introduced.

References:

[1] S. Awaji et al., *Supercond. Sci. Technol.*, **29** (2016) 05510.

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