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[Invited] High in-field I_c and Low AC-loss with Low Cost Coated Conductors for Electric Propulsion Transportation in Japan

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REBCO coated conductors (REBCO-CC) have attractive features such as high I_c performances even in the magnetic fields. As the applications which can effectively use the features, “electric propulsion transportation” is considered to be strong candidate. In the system, several superconducting devices can be applied such as “Generator”, “Motor” and “Cable”. If all superconducting rotating machine can be realized, the advantages in generator and motor should be stronger. In order to actualize the superconducting transportation system, the REBCO-CC with high-performances such as high I_c in both self-field & external field and low ac-loss has to be prepared. Additionally, low cost CC is always desired. In this paper, the present status of CC in Japan is reviewed for the electric propulsion transportation.

Concerning an improvement of in-field performance, APC-introduction has been known to be valid. In the PLD process, it was found that the material combination of EuBCO and BaHfO_3 is more effective to obtain high I_c in the magnetic field. It revealed high performance in wide ranges of temperature and magnetic field. As a typical value, the high I_c ($I_c(B)$) value of 569 A/cm-w under $3T(I_c(B)/c)$ at 65 K . On the other hand, the break-through was taken place in R&D of TFA-MOD process, which is known as a cost effective process. The in-field I_c value was remarkably improved by thinning once coat-thickness in the MOD process. Additionally, the scribing technique has been developed to make filament-structure in the coated conductors to reduce ac-losses. An ac-loss reduction even in the 100 m long tapes was actually confirmed. Furthermore, the validity could be maintained even in the coil shale. It should lead to realization of low loss armature coil in the all superconducting rotating machines.

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