



Contribution ID: 927

Type: **Invited Oral Presentation**

M2Or2B-01 [Invited]: Improvement of In-field Performance of Coated Conductors in Liquid Nitrogen

Tuesday 23 July 2019 11:00 (30 minutes)

Coated conductors have high potentials for the wide application field especially in a magnetic field at high temperature. Recently, an electric propulsion system for aircraft using superconducting technologies has been considered to aim a high power density. In our design of the system, the superconducting generators and motors are connected by the superconducting cables. In this system, the liquid nitrogen is poured through all devices in series. The temperature has to be rising from 65 K of the initial temperature. Therefore, the high in-field performance at high temperature over 65 K is required.

The APC (Artificial Pinning Center)-control technologies to improve the in-field performances has been developed both in the PLD (Pulsed Laser Deposition) and the TFA-MOD (Metal Organic Deposition) processes on the IBAD (Ion-Beam Assisted Deposition) template. In the PLD films, a heavy doping BMO (BaMO_x, M: metal element) nano-rods has been attempted. The optimization of growth conditions to avoid the T_c-deterioration and anneal ones to inject enough oxygen gave us the higher in-field J_c value such as 2.9 and 1.4 MA/cm² at 65 and 70 K, 3 T, respectively. On the other hand, a new TFA-MOD process, which is called as the UTOC (Ultra-Thin Once Coating) -MOD, was developed to make the BMO nano-particles finer. In this process, the once coating thickness is reduced and it makes the diffusion barrier to suppress the growth of the APC particles. As a result, the extremely high J_c values of 2.9 and 1.9 MA/cm² at 65 and 70 K, 3 T were obtained, respectively. The remarkable progress in both films was achieved and these ought to lead to the aircraft applications.

A part of this work has been supported by METI, NEDO, AMED.

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Session Classification: M2Or2B - Focus Series B: REBCO Flux Pinning II