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## M2Or4B-01: [Invited] High quality FF-MOD REBCO films prepared from ready-made REBCO

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The fluorine-free metal organic decomposition (FF-MOD) method is considered to be the lowest cost one for mass production of REBCO thin films among various methods such as Pulsed-Laser-Deposition (PLD), Metal-Organic-Chemical-Vapor-Deposition (MOCVD), trifluoroacetate (TFA)-MOD and Reactive Co-Evaporation by Deposition & Reaction (RCE-DR). Fast crystal growth of REBCO via simple reaction, flat and clean surface, simple and low cost production system and less material loss are the advantageous points FF-MOD method. However, FF-MOD processed REBCO tapes have not been popular because of low  $J_c$  under magnetic field originated in very high crystallinity of REBCO layer with less defects acting as pinning centers. Recent successful studies on the introduction of fine nonsuperconducting precipitates in REBCO layer, increase in the thickness of the layer by multiple sintering process and establishment of coating techniques to fabricate long tapes [1] strongly suggested the high potential of FF-MOD method.

Acetates or acetylacetonates (acac) of constituent metals are used in most of studies to fabricate REBCO films by the FF-MOD method, however, these reagents are not inexpensive and some of them are hydrates, resulting in difficulty in precise control of the cation composition. Recently, we have developed a new method to prepare FF-MOD solutions with low cost, high productivity, high homogeneity and well-controlled cation compositions.

YBCO fine powder was found to be dissolved in propionic acid at room temperature, which is an exothermic reaction. Increasing dissolving temperature up to the boiling point (414 K) of propionic acid promotes reaction and, therefore, we can use ready-made REBCO sintered bulks as starting materials. After evaporating excess solution, propionate crystals containing RE, Ba and Cu were obtained. Powder X-ray analysis revealed that the propionate crystals contain multiple cations, such as RE, Ba and Cu. FF-MOD solutions were prepared by dissolving the propionate crystals in a mixed solvent of methanol, butanol and water. Through coating solutions on SrTiO<sub>3</sub> single crystals and IBAD substrates and heat-treatments, high  $J_c$  REBCO films were successfully synthesized with high reproducibility under wider sintering conditions expanding lower temperature down to 993 K for YbBCO. These characteristics are preferable for development of long length tapes as well as fabrication of superconducting joints connecting REBCO tapes. Details of the critical current properties of REBCO films including the doping effect will be shown.

[1] T. Yoshihara, G. Honda, T. Nagaishi, S. Kobayashi, K. Kanie, T. Okada, and S. Awaji, IEEE Trans. Appl. Supercond., 33, 6600205 (2023)

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