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Wed-Af-Po.05-03: Enhanced Critical Current Densities via Co-doped RE214 Artificial Pinning Centers in FF-MOD Gd123 Films

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We have fabricated Gd123 thin films co-doped with several kinds of RE_2CuO_4 (*RE*214: *RE* = Gd, Nd, Sm, Eu) by the FF-MOD method and investigated their superconducting properties. We have already reported that the introduction of the superconductor *RE*214 (Tc = 18.5 K) as an artificial pinning center (APC) into *RE*123 thin films which improved the Jc-B properties for the first time [1]. In this study, we introduced multiple types of *RE*214 with different lattice constants into the base Gd123 material for finer *RE*214 crystals and attempted to further improve the Jc-B properties. As a result, with the same volume fraction of *RE*214 introduced, the Jc-B properties improved as the number of different types of *RE*214 co-doped increased, and all films showed better Jc-B performance compared to non-doped films. At 4.2 K and 6.9 T parallel to the c-axis of Gd123 thin films, the Jc was 0.782 MA/cm² with the addition of Sm214 and 0.877 MA/cm² with the addition of three types (Gd214, Nd214, Sm214), representing increases of 1.07 times and 1.19 times, respectively, compared to the non-doped film. TEM images also confirmed that the *RE*214 pins were oriented along the c-axis, and it is inferred that they are introduced in a plate-like manner within the ab-plane. Therefore, it is expected that applying a magnetic field perpendicular to the c-axis during magnetization measurements could result in even higher calculated Jc values.
Moving forward, further improvements in superconducting properties are expected by altering the combinations of *RE* in *RE*214, their doping ratios, and the sintering conditions.

References

[1] R.Ishii, O.Miura,"Achievement of high critical current densities by co-doping Ba*M*O3 (*M*= Zr, Ce, Sn) and Gd2CuO4 for FF-MOD GdBa2Cu3O7-σ thin films", The Applied Superconductivity Conference2024, Utah(U.S.A), September 2024.

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