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Superior RE123 bulks with small RE211 particles in-situ self-formed at temperature above Tp

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The refinement of RE2BaCuO5 (RE211) particles is a matter of significant importance in fabricating high-performance REBa2Cu3O7-⊠ (RE123) superconductor bulks by top-seeded melt growth (TSMG). However, RE211 coarsening and RE123 peritectic decomposition naturally promote a continuous growth of the pre-existing RE211 during the heating up to the maximum processing temperature (Tmax), causing an unwanted size enlargement.
Here, we report a novel TSMG approach in which with absence of RE211, modified precursor powders (MPP, RE2O3, and Ba-Cu-Ox) were employed to fabricate RE123 bulks (RE= Y, Sm in this work). As a result, there is neither RE211 in the beginning nor related enlargement behaviour in the heating stage. Upon exceeding peritectic temperature (Tp), a peritectic solidification of RE2O3 + Ba-Cu-Ox ⟶ RE211 instantaneously and simultaneously occurs, characterized by nucleation catastrophe. That is to say, spontaneously, the massive small sized RE211 in-situ formed at Tmax, ultimately yielding fine and evenly distributed RE211 particles in the grown RE123 bulks. Consequently, the MPP-processed superior RE123 bulks with superior properties were achieved.

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