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Sm123 bulk superconductors composited by small-sized Sm211 particles formed by homogeneous nucleation catastrophe

*Yiqian Yin[1,2], Yan Liu[1,2], Jun Qian[1,2], Yan Wan[1,2], Simin Huang[1,2], Yanhan Zhu[1,2], Xin Yao[1,2,4], Pavel Diko[3]

Key Lab of Artificial Structures & Quantum Control (Ministry of Education), School of Physics and Astronomy, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai, 200240, China[1]
State Key Lab for Metal Matrix Composites, School of Materials Science and Engineering, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai, 200240, China[2]
Institute of Experimental Physics, Slovak Academy of Science, Watsonova 47, 04001 Košice, Slovakia[3]
Author to whom correspondence should be addressed[4]

The refinement of RE_2BaCuO_5 (RE211) particles is of significant importance in preparing high performance $REBa_2Cu_3O_{7-\delta}$ (RE123) bulks by top-seeded melt-growth (TSMG). However, the pre-existing RE211 phase in the conventional precursor powder (CPP) inevitably results in its size-enlargement caused by coarsening and epitaxial growth. In our previous work, a novel modified precursor powder (MPP, Y_2O_3 and $Ba_2Cu_3O_5$) has been used to enhance the performance of $YBa_2Cu_3O_{7-\delta}$ bulks with Y211 nanoparticles. Here, we extended that new conception in the preparation of $SmBa_2Cu_3O_{7-\delta}$ bulks to reduce Sm211 size. Additionally, in order to suppress the Sm/Ba substitution, we replaced $Ba_2Cu_3O_5$ with $Ba_3Cu_4O_7$ to apply Ba-rich MPP (B-MPP). As a consequence, improved levitation force was achieved from the novel processed $SmBa_2Cu_3O_{7-\delta}$ bulk. Most importantly, this time and cost saving method is feasible to prepare other light rare-earth superconductor bulks (LRE123, LRE=Gd, Nd) with high performance.

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