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M1Po2A-01 [25]: Synthetic Route to Eliminate Oxide Byproducts and Its Effects on Intergrain Connectivity in K-doped BaFe₂As₂ Polycrystalline Bulks

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Practical applications of high temperature superconductors (HTS) usually demand long length wires in which the materials are inevitably polycrystalline. The critical temperature at 38 K and the high upper critical field around 90 T make K-doped BaFe₂Fe₂ (Ba122) attractive as a high field conductor. The last key aspect which needs to be demonstrated is high J_c in polycrystalline forms such as a bulk, wire or tape. Improving the connectivity between grains is the key fundamental to make the J_c of this material competitive as a practical HTS. Indeed the grain connectivity can be easily degraded by local or global impurity concentration and cracks at the grain boundaries (GBs). Such an unpredictable GB connectivity often causes the poor reproducibility of intergrain J_c. Our extensive analytical microscopy studies revealed that barium and potassium can segregate at the GBs along with the oxide byproducts in the final bulks. Since then, we started to evaluate the synthesis environment, especially the oxygen and moisture level inside the glovebox, tracking back the possible oxygen sources while preparing samples as well as the purity of starting materials. Utilizing high purity starting materials and very low oxygen and moisture levels inside glovebox (0.005 ppm and 0.05 ppm, respectively) suggested that the reproducibility of the intergrain connectivity largely depends on the K purity. Our recent compositional studies also indicated that the local K composition at the GBs must not be excessive. Our understanding and efforts on eliminating the source of byproducts will lead to the more sophisticated synthesis route for high J_c polycrystalline bulks towards the wires. More details will be discussed in the presentation.

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