Investigation of Yttrium Addition Effects in K-doped $BaFe_2As_2$ Polycrystalline Bulk Superconductor

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$Ba_{0.6}K_{0.4}Fe_2As_2$ (K-Ba122) [1] has gained significant attention owing to its current-carrying capability under high-magnetic fields, high critical temperature of 38 K, large upper critical field of more than 50 T and small anisotropy, making it promising for magnet applications [2]. One of the challenges in the polycrystalline K-Ba122 development is the existence of FeAs and BaO impurity segregations at grain boundaries[3-5]. In this study, yttrium is introduced as an additive. Yttrium is expected to form Y_2O_3 due to its lower formation energy than BaO[6], thus preventing BaO formation during material synthesis. Polycrystalline K-Ba122 bulks were synthesized by mechanical alloying of elemental metals via high-energy milling[7], followed by subsequent heating of the resulting precursor powder through Spark Plasma Sintering (SPS) method. The SPS method facilitates rapid densification and enables grain growth suppression through Ohmic heating[8]. Herein, yttrium concentration was varied to identify its effects on the physical and structural characteristics of K-Ba122 bulks. In addition, SPS parameters were tuned to obtain high quality polycrystalline bulks. X-ray diffraction analysis and microstructure observation were conducted to evaluate the phase composition. The superconducting properties will be reported.

References

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