# Homogeneous Supercurrents in a Large $CaKFe_4As_4$ Superconducting Bulk

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Iron-based superconductors (IBSs) have attracted attention as promising materials for next-generation high-field applications, and research and development efforts have primarily focused on so-called 122-type IBSs such as $Ba_{1-x}K_xFe_2As_2$. We have found that $CaKFe_4As_4$ (1144 type) [1] has high potential in critical current properties [2,3] and worked on the fabrication and performance enhancement of $CaKFe_4As_4$ superconducting bulk samples [4,5]. For bulk magnet applications like nuclear magnetic resonance, it is crucial not only to achieve strong magnetic fields but also to obtain high-quality (homogeneous) magnetic fields and facilitate large-scale bulk production. Therefore, in this study, we fabricated large $CaKFe_4As_4$ bulk samples and evaluated their trapped magnetic field distribution.

Figure (a) shows a photograph of a bulk sample with a diameter of 65 mm and a thickness of 15 mm, produced using the spark plasma sintering (SPS) method. The weight of bulk was 257 g, and the density was estimated to be 5.16 g/cm³, approximately 98% of the theoretical density (5.22 g/cm³), indicative of a high density. Figure (b) presents a contour plot of the magnetic field distribution measured on the bulk surface using a scanning Hall probe after zero-field cooling and magnetizing. The concentric pattern of the magnetic field distribution suggests a uniform supercurrent within the bulk, demonstrating its capability to generate a high-quality magnetic field.

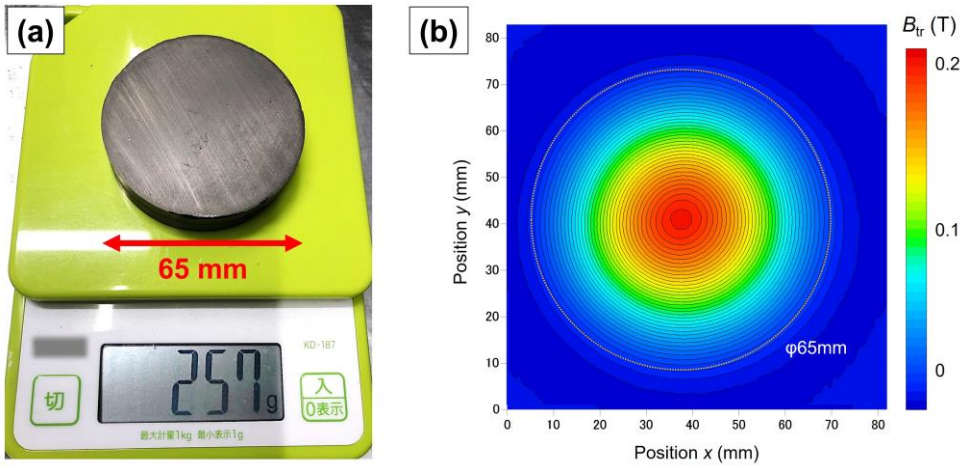


Figure caption: (a) Photograph of the φ65 mm $CaKFe_4As_4$ bulk on a scale, indicating the weight of 257 g. (b) Contour plot of magnetic field distribution at 10 K measured at a height of 5 mm from the bulk surface.

**References**

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