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Critical Current Density and Its Enhancement by Particle Irradiation in $KCa_2Fe_4As_4F_2$

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$KCa_2Fe_4As_4F_2$ is a new iron-based superconductor (IBS) with T_c ~ 33 K having a layered structure, where Fe_2As_2 double layer in KFe_2As_2 is sandwiched by Ca_2F_2 layers. This is another stoichiometric IBS similar to $CaKFe_4As_4$, where we have reported a very large critical current density (J_c) due to the presence of novel layered defects parallel to the *ab*-plane [1]. In the present study, we have grown high-quality single crystals of $KCa_2Fe_4As_4F_2$ and characterized J_c properties including its anisotropy and homogeneity.

Single crystals of $KCa_2Fe_4As_4F_2$ are grown by the flux method. J_c as functions of magnetic field (//*c*-axis) at temperatures between 2 K and 30 K are shown in Fig. 1. The self-field J_c at 2 K reaches ~8 MA/cm^2, which is larger than any other IBSs. However, unlike the case of $CaKFe_4As_4$, no defect structures are found by TEM observations. Magneto-optical imaging shows that shielding currents flow rather homogeneously throughout the crystal. For *H*//*ab*, the average J_c is much smaller than that for *H*//*c*-axis, probably due to the large anisotropy of this material. Effects of particle irradiation on the enhancement of J_c will also be reported.

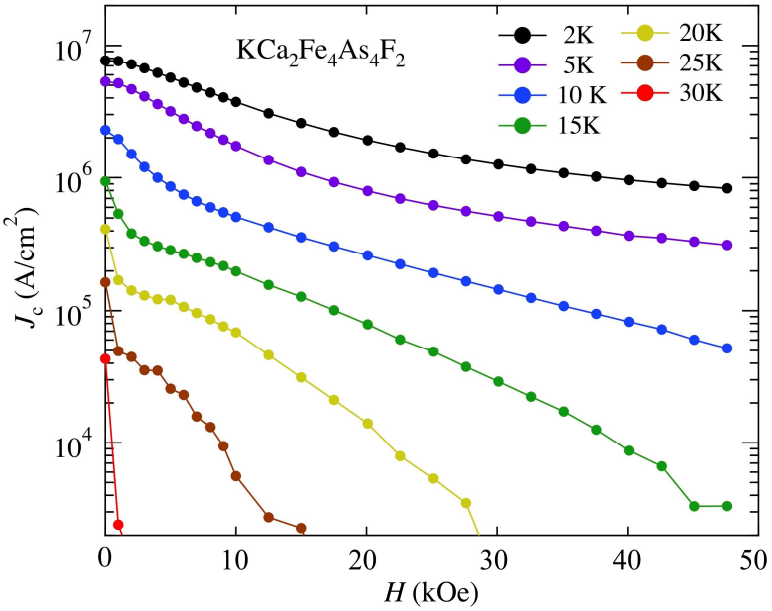

Fig. 1 Magnetic field (*H*//*c*) dependence of J_c in $KCa_2Fe_4As_4F_2$ at various temperatures.

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