

## PCP4-8

### Effects of Splayed Columnar Defects on Critical Current Density in CaKFe<sub>4</sub>As<sub>4</sub>

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Introduction of columnar defects to superconductors through particle irradiation enhances their critical current density ( $J_c$ ) [1,2]. Further enhancement of  $J_c$  by dispersing the direction of columnar defects has been confirmed in cuprates YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  [3] and iron-based superconductors (IBSs) Ba<sub>1-x</sub>K<sub>x</sub>Fe<sub>2</sub>As<sub>2</sub> [4] single crystals. Moreover, in such systems with splayed columnar defects, an anomalous peak effect in  $J_c$  at a certain magnetic field determined by the irradiation dose as well as an in-plane anisotropy of  $J_c$  between those parallel and perpendicular to the splay direction were observed [4, 5].

Here, we introduce splayed columnar defects to CaKFe<sub>4</sub>As<sub>4</sub> single crystals, which was recently found as a new type of IBSs (1144-type IBS) [6], by irradiating 2.6 GeV U and 320 MeV Au ions and measure their  $J_c$  properties.  $J_c$  in CaKFe<sub>4</sub>As<sub>4</sub> is also enhanced by splayed columnar defects at 5 K under zero field from 1.5 MA/cm<sup>2</sup> in the pristine crystal to 17 MA/cm<sup>2</sup> as shown in Fig. 1(a) for the case of  $\theta_{CD} = \pm 20^\circ$  and  $B_\Phi = 4 \text{ T} + 4 \text{ T}$ . It should be noted that the anomalous peak effect at  $\sim 1/3 B_\Phi$  as observed in Ba<sub>0.6</sub>K<sub>0.4</sub>Fe<sub>2</sub>As<sub>2</sub> (Fig. 1(b)) in the same irradiation condition disappears in CaKFe<sub>4</sub>As<sub>4</sub>. We interpret that the suppression of the anomalous peak effect in CaKFe<sub>4</sub>As<sub>4</sub> is due to the presence of planar defects parallel to the  $ab$ -plane, which is unique to this material. We also compare the in-plane anisotropy of  $J_c$  in Ba<sub>0.6</sub>K<sub>0.4</sub>Fe<sub>2</sub>As<sub>2</sub> and CaKFe<sub>4</sub>As<sub>4</sub> with splayed columnar defects.

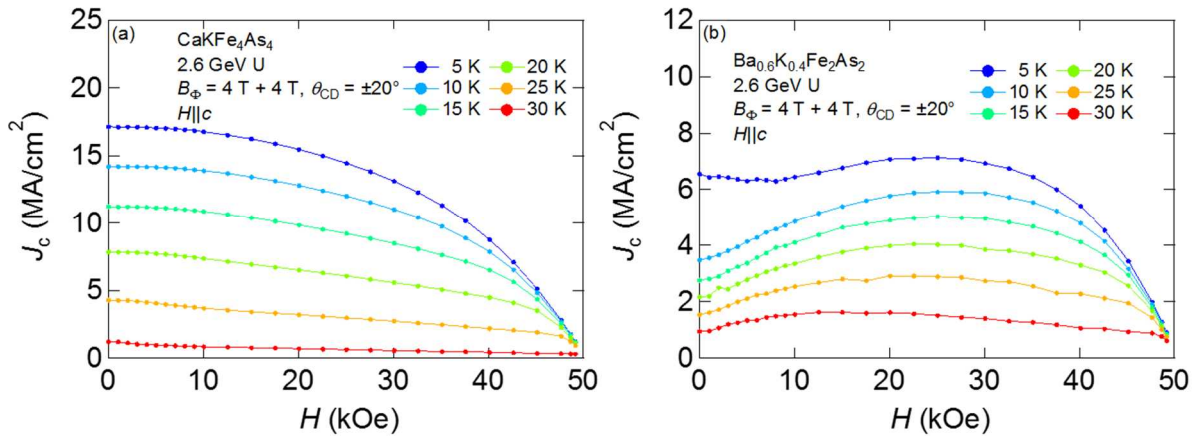


Fig. 1: Magnetic field dependences of  $J_c$  at various temperatures in (a) CaKFe<sub>4</sub>As<sub>4</sub> and (b) Ba<sub>0.6</sub>K<sub>0.4</sub>Fe<sub>2</sub>As<sub>2</sub> that are irradiated by 2.6 GeV U ions with  $B_\Phi = 4 \text{ T} + 4 \text{ T}$  and  $\theta_{CD} = \pm 20^\circ$ .

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