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High Dose Heavy-Ion Irradiation Effects on the Multi-band Superconductor ($\mathbf{Ba_{0.6}K_{0.4}}$)$\mathbf{Fe_2As_2}$[1] LEI FANG, CARLOS CHAPARRO, GOUTAM SHEET, YING JIA, SHAO-FEI ZHU, Argonne National Laboratory, HE-FEI HU, JIAN-MIN ZUO, University of Illinois at Urbana-Champaign, HAI-HU WEN, Nanjing University, China, ULRICH WELP, ALEXEI KOSHELEV, GEORGE CRABTREE, WAI-KWONG KWOK, Argonne National Laboratory — Optimal doped crystals of $(Ba_{0.6}K_{0.4})Fe_2As_2$were irradiated with 1.4 GeV Pb ions to dose-matching fields ranging from 4 Tesla to 21 Tesla. Plan-view transmission electron microscopy shows creation of defects with diameters of $2 \sim 5$ nm. Post-irradiation characterization shows that the superconducting anisotropy is reduced to near unity, probably due to the increase in intra-band scattering. In addition, the critical current density J_C determined from magnetization measurements shows systematic enhancement up to $\sim$5 MA/cm^2 at T=5K. We show that the decay of the critical current with magnetic field can be greatly mitigated with dense defects with approximately 20nm spacing produced by a dose matching field irradiation of 21T. Remarkably, the superconducting transition temperature remain unchanged for all matching field irradiation, suggesting that inter-band scattering due to non-magnetic impurity does not play a dominant role in pair-breaking.

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Lei Fang
Argonne National Laboratory

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