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Substantial enhancement of critical currents by heavy-ion irradiation in single crystals of Co and Ni doped 122 pnictide superconductors: a magneto-optical study R. PROZOROV, M.A. TANATAR, B. ROY, N. NI, S.L. BUD'KO, P.C. CANFIELD, Ames Laboratory and Department of Physics & Astronomy, Iowa State University, Ames, IA 50011, J. HUA, U. WELP, W.K. KWOK, Materials Science Division, Argonne National Laboratory, Argonne, IL 60439 — Single crystals of $Ba(Fe_{1-x}T_x)_2As_2$ (T=Co, Ni) were irradiated with 1.4 GeV Pb ions at different fluencies to produce pinning centers of controlled density. Magneto-optical imaging utilizing the Faraday effect in iron-garnet ferrimagnetic films has been used to map the distribution of the magnetic induction in the irradiated samples. The results show a substantial enhancement of the apparent critical current densities at all temperatures as revealed by the much larger Bean penetration fields that scale with the density of the irradiation-induced defects. Magneto-optical observations are supported by the conventional magnetic measurements revealing a large increase of the hysteretic magnetization. Given the quite three-dimensional nature of iron-based pnictide superconductors, our results suggest that irradiation with heavy ions is a very effective way to enhance the current-currying capabilities of these novel superconducting materials.

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