Effects of Swift Xe Irradiation in $Ba(Fe_{1-x}Co_x)_2As_2$ Single Crystals

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We have systematically investigated the effects of particle irradiation in optimally Co-doped $BaFe_2As_2$. In the case of 200 MeV Au irradiation with a dose of $B_\phi = 20$ kG, the value of critical current density (J_c) is successfully enhanced around 5 times without appreciable reduction of superconducting transition temperature (T_c).[1] By contrast, 3 MeV proton irradiation with a dose of 1.2×10^{16} cm^{-2} suppresses T_c more than 10 %, while the value of J_c is 2.5 times larger than that in pristine samples.[2] These results are consistent with an introduction of columnar defects and point defects, respectively. The irradiation of Xe ions, on the other hand, introduces cascade defects with increasing doses, which is confirmed by TEM observations. Reflecting such a morphology, T_c in this system should be reduced. Here we report the details of suppression rates of T_c in optimally Co-doped $BaFe_2As_2$ irradiated by 300 MeV Xe along c-axis without an ambiguity of piece dependencies. We also discuss the more effective pinning center morphology for vortices by comparing the enhancement of J_c.

[1]Y. Nakajima *et al.*, Phys. Rev. B **80**, 012510 (2009).
[2]T. Taen *et al.*, to be published in Physica C.