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Tailored Large Critical Currents in Iron-based Superconductors[1]

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Iron-based superconductors, with their relatively high superconducting transition temperatures, high critical currents and low anisotropy holds great potential for applications such as superconducting generators and motors where the magnetic field environment can greatly affect the critical current capacity. These materials may hold the key to developing an isotropic, high field, high critical current, high-temperature superconductor, one of the grand challenges of applied superconducting research. I will discuss our recent work on using various types of particle irradiation to elucidate the vortex pinning behavior of these materials and the remarkable enhancement of the critical current that can be achieved with no detrimental effect on the transition temperature. Furthermore, I will show that certain induced correlated disorder can lower the thermodynamic anisotropy of these superconductors. Finally, I will discuss the advantages of composite defects induced by compounded proton and heavy-ion irradiation in further enhancing the critical current at high magnetic fields. These results on iron-based superconductors will be compared with the performance of current state-of-the-art commercial YBCO coated conductors.

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