

Exploring the flux pinning performance of bulk FeSe by electron irradiation

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Abstract: Bulk, polycrystalline samples of FeSe are interesting candidates for trapped field applications as the material can be prepared by simple solid-state sintering, is free of toxic elements and exhibits magnetic properties like the copper-based high- T_c superconductors, i.e., high upper critical fields H_{c2} , and relatively small anisotropy. Polycrystalline, sintered FeSe material shows further promising features such as strong grain coupling. The FeSe material consists of well-coupled, but randomly oriented, platelet-like round grains with a diameter between 1 and 6 μm . However, the critical currents of the FeSe system are still low, but comparable to sintered MgB_2 . The goal of the present work is to explore the possibilities of the FeSe system in application-type samples (i.e., polycrystalline material, not single crystals) using electron irradiation. Pieces of bulk, superconducting FeSe samples prepared by solid-state sintering were irradiated with 2.5 MeV electrons ($T = 23.5$ K) at SIRIUS facility using two different fluences, 2×10^{19} electrons/ cm^2 and 4×10^{19} electrons/ cm^2 . The electron irradiation introduced point defects to the FeSe grains. The changes of T_c due to irradiation and the critical currents were measured using SQUID magnetometry. As result, the superconducting transition temperature, T_c , is slightly reduced, depending on the fluence, but the critical currents are increased by about 20-30%, which demonstrates that one can introduce additional disorder to FeSe to improve the flux pinning properties also in the polycrystalline material.

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