IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 60, Sept. 2025

Exploring the Impact of Irradiation Fluence on Shaping the Superconducting Performance of $EuBa_2Cu_2O_{7-\delta}$

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***Abstract*–Manipulating pinning centers via irradiation has been recognized as a powerful technique for optimizing superconducting properties. The type, fluence, and energy of irradiating particles determine the nature of the defects formed in the material, each influencing superconducting properties in distinct ways. Here, by tuning the Xe irradiation fluence within the range of 10^{10} to 10^{12}, we reveal the impact of irradiation fluence on the superconducting performance of $EuBa_2Cu_2O_{7-\delta}$ (EBCO) across different magnetic field ranges. A lower fluence (10^{10} ions/cm^2) enhances critical current at low-field (below 1T), while moderate fluence (10^{11} ions/cm^2) improve critical current at high-field. By further increasing the fluence up to 10^{12} ions/cm^2, superconductivity is significantly suppressed due to oxygen disordering, as evidenced by Raman spectra. More interestingly, these behaviors show weak dependence on both the temperature and thickness of EBCO. This work shows a promising avenue to effectively manipulate superconducting performance through irradiation fluence, particularly for applications under magnetic field.**

***Keywords (Index Terms)*–Flux Pinning, Irradiation, REBCO Films, Wires and tapes**

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Presentation given at IREF 2025, Gallipoli, Italy, June 2025.