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Influence of ion irradiation on iron-chalcogenide superconducting films TOSHINORI OZAKI, WEIDONG SI, CHENG ZHANG, LIJUN WU, QIANG LI, Brookhaven National Laboratory — Iron-chalcogenide superconductors have rather simple crystal structure and no charge reservoir. They also exhibit remarkable properties including small anisotoropy, high upper critical fields, a significant pressure effect on superconductivity. We have grown iron-chalcogenide FeSe0.5Te0.5 (FST) superconducting films on various substrate by pulsed laser deposition [Rep. Prog. Phys. 74, 124510 (2011)]. The FST films on CeO2 buffer layer exhibit enhanced Tc (Tc^{onset} >20 K, Tc^{zero} = 18.0 K), which is about 30% higher than that found in the bulk materials and superior high field performance over the low temperature superconductors. [Nature Commun. 4, 1347 (2013)]. Recently, we were successful in further enhancement of Jc without Tc degradation by ion irradiation, especially, at high temperature and high magnetic field. The low-energy proton irradiation produces a Jc enhancement of one order of magnitude over the field of 6T//c at 12 K. Extensive TEM studies of the irradiated FST films have been carried out, which revealed an intriguing defect morphology provided by the irradiation. We will discuss the relationship between the superconducting properties and the created defects of the iron-chalcogenide films.

Toshinori Ozaki
Brookhaven National Laboratory

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