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Study on the electrical property of He ion-irradiated thin film superconductor MgB_2

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Magnesium diboride (MgB_2) is a conventional superconductor that has high critical temperature (T_c ~ 39 K) and current density (J_c), making it a promising candidate for various applications [1]. Ion irradiation on MgB_2 thin films induces disorder through atomic lattice displacement, which reduces T_c [2,3]. In this study, we investigated the influence of He ion irradiation on the MgB_2 thin films with thicknesses of 170 nm and 570 nm, under various irradiation doses. The changes in crystallinity and superconducting transition temperature of irradiated MgB_2 thin films were observed by x-ray diffraction (XRD) and electrical resistivity measurements, respectively. Our results showed that all main peaks in the XRD patterns shifted due to He ion irradiation. As the dose increased, T_c systematically decreased. However, even at the highest dose (4.8×10^{16} ions/cm^2), T_c remains significant, around 8 K, which suggests that the superconductivity of MgB_2 thin films remains robust despite the disorder induced by He ion irradiation. Furthermore, we will discuss the recovery of T_c through thermal annealing on the irradiated MgB_2 thin films.

[1] Nagamatsu, J., Nakagawa, N., Muranaka, T. et al., "Superconductivity at 39 K in magnesium diboride" *Nature* **410**, 63–64 (2001)
[2] Soon-Gil Jung et al., "Influence of carbon-ion irradiation on the superconducting critical properties of MgB_2 thin films"*Supercond. Sci. Technol.* **32** (2019) 025006
[3] Jung Min Lee et al., "Influence of disorder strength on the superconducting mechanism of MgB_2"*Supercond. Sci. Technol.* **35** (2022) 015001

Paper submission Plan

No

Best Presentation

No

Contribution track

KOPUA

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