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

Minju Jeonga, Han Yoona, Tuson Parkb, Soon-GilJungc and Soonbeom Seoa\*

a *Department of Physics, Changwon National University, Changwon 51140, Republic of Korea*

b *Center for Quantum Materials and Superconductivity (CQMS), Department of Physics, Sungkyunkwan University, Suwon 16419, Republic of Korea*

c *Department of Physics Education, Sunchon National University, Suncheon 57922, Republic of Korea*

A conventional superconductor MgB2 is considered as a candidate for various applications due to its high critical temperature (Tc~39K) and current density (Jc) [1]. Ion irradiation on MgB2 thin films induces disorder caused by the atomic lattice displacement, which leads to the reduction of Tc [2,3]. In this study, we investigated the influence of He ion irradiation on the MgB2 thin films of thicknesses of 170 nm and 570 nm with various does of irradiations. Changing of lattice constant and superconducting transition temperature of irradiated MgB2 thin films were observed by x-ray diffraction (XRD) and electrical resistivity measurements, respectively. Tc systematically decreases with increasing irradiation dose, however Tc is still present near 8 K at maximum does (4.8x1016 #/cm2), meaning that superconductivity of MgB2 thin film is robust against disorder produced by He ion irradiation. Furthermore, we will discuss the recovery of Tc through thermal annealing on the irradiated MgB2 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 MgB2 thin films*” Supercond. Sci. Technol.* **32** (2019) 025006

[3] Jung Min Lee *et al*., “Influence of disorder strength on the superconducting mechanism of MgB2” *Supercond. Sci. Technol.* **35** (2022) 015001