

TEM Studies of the Superconducting MgB₂ Thin Films Deposited by HPCVD

Jun-Ki Chung^a, Won-Jeong Kim^a, Won Nam Kang^b, Won Kyung Seong^b,
Chan-Joong Kim^c, Cheol Jin Kim^d

^a *Institute of Industrial Technology, Changwon National University Changwon, Korea*

^b *BK21 Physics Division and Department of Physics, Sungkyunkwan University, Suwon, Korea*

^c *Korea Atomic Energy Research Institute, Taejeon, Korea*

^d *i-cube center, Gyeongsang National University, Jinju, Korea*

As-grown MgB₂ thin films were deposited on *c*-plane (0 0 1) sapphire substrates by using a HPCVD (hybrid physical-chemical vapor deposition). The crystalline MgB₂ layer has about 1.1 μm and 1.7 μm in thickness. To investigate the correlation between microstructural features and superconducting properties of the MgB₂ thin films with different thickness, HRTEM (high resolution transmission electron microscopy), STEM (scanning TEM), SAED (selected area electron-diffraction) and EDX analyses were performed. Surface and cross-sectional TEM specimens of the MgB₂ thin film were prepared with a focused ion beam (FIB) method. The average grain size for MgB₂ thin films with thickness of 1.1 μm and 1.7 μm has a 190 nm and 230 nm, respectively. The Cross-sectional transmission electron microscope images showed that the MgB₂ thin films deposited on *c*-plane sapphire substrates contain columnar structures. According to the results of SAED patterns and HRTEM, the MgB₂ thin films had including the amorphous MgB₂ also had *c*-axis orientation.

Keywords: MgB₂, thin films, HPCVD, TEM, HRTEM