Fabrication of MgB_2 Thick Films on Various Buffer Layers by Using Hybrid Physical-chemical Vapor Deposition Method.

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We have fabricated MgB_2 thick films on *c*-cut Al_2O_3 substrates with various buffer layers of Ni, Ti, and SiC by using hybrid physical-chemical vapor deposition (HPCVD). Firstly, we have deposited Ni, Ti, and SiC on Al_2O_3 substrates for the growth of buffer layer by using pulsed laser deposition technique. The deposition time of buffer layers was 1, 2, 5, and 10min, respectively. And then the MgB_2 films have grown by HPCVD system at the low temperature of 480℃ for 10 min. The as-grown MgB_2 films showed superconducting transition temperatures of ~40 K with transition width of 0.2 ~ 0.6 K and the average MgB_2 film thickness was about 3.8 μm. The X-ray diffraction patterns indicated that the MgB_2 thick films had a highly c-axis-oriented crystal structure normal to the buffer layer substrate surface. The average grain size of buffered samples shown 400 ~ 700 nm in diameter, it was observed by a scanning electron microscope. We have found a significant enhancement of the critical current density (J_c) for MgB_2 films grown on buffer layered substrates, indicating that additional buffer layers were provided possible pinning sites by chemical doping in MgB_2 films. The J_c of MgB_2 films grown on Ni, SiC buffered substrates showed best J_c performance of low and high field region, respectively.

Keywords: MgB_2, HPCVD, buffer, buffer layer, Ni, Ti, SiC