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**Upper Critical Field of Carbon-doped $MgB_2$ Thin Films by HPCVD Using TMB** WENQING DAI, Physics Department, Penn State University, DWIGHT RICKEL, Los Alamos National Laboratory, XIAOJUN WENG, MRI, Penn State University, KE CHEN, Physics Department, Temple University, JOAN REDWING, Department of MSE, Penn State University, QI LI, Physics Department, Penn State University, XIAOXING XI, Physics Department, Temple University — We report $H_{c2}$ measurements in high magnetic field up to 60 T on carbon-doped $MgB_2$ thin films. About 100 nm thick carbon-doped $MgB_2$ films were fabricated by the Hybrid Physical-Chemical Vapor Deposition (HPCVD) method using Trimethylboron (TMB) as the doping source. For heavily doped $MgB_2$ films, high slope $-dH_{c2}^{//ab}/dT$ near $T_c$, as large as 8.3 T/K, was obtained for a sample with the $T_c$ of 32.3 K. The $H_{c2}$(T) in ab-plane has a downward curvature and is above 60 T at low temperatures. The c-direction $H_{c2}$ is close to 20 T. The $H_{c2}$ anisotropy increases with carbon-doping, as opposed to the reported results from other carbon-doping techniques. The TEM study shows the $MgB_2$ forms many nm thick layers sandwiched in the $MgB_2C_2$ matrix. Using two-gap dirty limit theory, the temperature dependences of $H_{c2}$ and abnormal $H_{c2}$ anisotropy in the heavily doped samples are explained by the presence of many very thin $MgB_2$ layers.

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