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Upper critical field and anisotropy in carbon alloyed MgB_2 thin films[1] QI LI, VALERIA FERRANDO, JUN CHEN, ALEXEJ POGREBNYAKOV, JOAN REDWING, XIAOXING XI, Penn State University, ALEX GUREVICH, DAVID LARBALESTIER, University of Wisconsin - Madison, J. B. BETTS, C. H. MIELKE, Los Alamos National Lab — We have studied the upper critical field and its anisotropy γ of C-alloyed MgB_2 thin films grown on (0001) SiC single crystal substrates by hybrid physical-chemical vapor deposition (HPCVD). Different concentrations of C were introduced during the deposition, which increased the residual resistivity systematically but did not affect T_c seriously. The upper critical field was found to increase to above 60 T for H parallel to the ab plane and up to $\sim$ 40T for H parallel to the c axis with even moderate amounts of C doping. Moreover, we show that H_{c2} stays at these levels in a wide range of C doping. The H_{c2} anisotropy was found to decrease as the C concentration increases. The $H_{c2}(T)$ curves for both $H \parallel ab$ and $H \parallel c$ directions were explained by a theoretical model of dirty limit two band superconductivity, which takes into account different scattering rates in π and σ bands, as well as interband scattering. The differences in the $H_{c2}(T)$ and $\gamma(T)$ for different samples can be explained by the differences of the relative scattering rates in each band which make it possible to adjust the π and σ scattering such that H_{c2} perpendicular to ab can attain almost 20T at 20K.

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