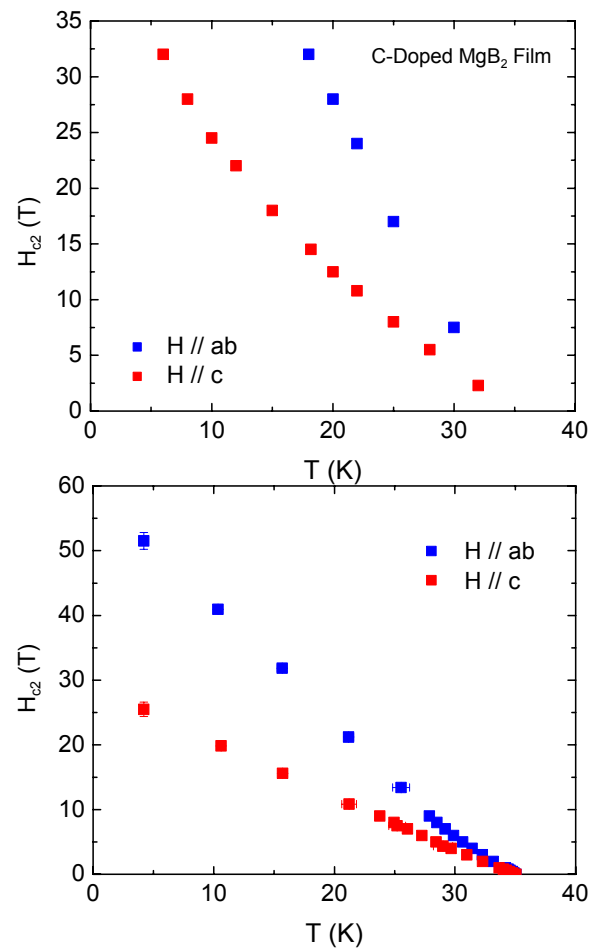
Study of multiband effects in MgB2 by controlling intraband and interband scattering inepitaxial films

Qi Li, Pennsylvania State University, DMR#0405502

Upper critical field H_{c2} of a superconductor is a critical property which determines its potential application in electrical power and magnetic field generation, such as magnets for MRI and high energy accelerator. Here we present initial results of H_{c2} of two C doped MgB_2 thin films measured in high magnetic fields, the upper one in DC fields and the lower one in pulsed fields. The results show record high H_{c2} with extrapolated value at low temperature of ~ 70 T (upper curve), much higher than that of currently used Nb_3Sn (H_{c2} ~ 30 T). Further research in the two-band effect of MgB_2 may lead not only to the understanding of the mechanism of the H_{c2} enhancement, but also possible applications of the material.

H_{c2} C doped MgB_2 films



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Education:

Three undergraduates, Julia Liu, Rich O'Hair, and Bao-Pung Truong participated in this project. Julia Liu participated on the REU site program in Physics Department of which I was the director, as well as the supplemental REU of this grant. Rick O'Haire went to graduate school in Scotland and Julia Liu is a senior at Duke. Two graduate students, Yufeng Hu and Eric Wertz, contributed to this work. Yufeng Hu received his Ph.D and is a postdoc at Brookhaven National Lab.

Societal Impact:

With record high H_{c2} and much lower material cost than currently used materials, MgB_2 certainly has a potential to be used in superconducting magnet and power applications. We are only at the beginning stage to study those effect and we expect more results to come in the future.