Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Carbon Inhomogeneity and Superconducting Properties of $Mg(B,C)_2$[1] L. D. COOLEY, A. J. ZAMBANO[2], A. R. MOODENBAUGH, Condensed Matter Physics and Materials Science Department, R. F. KLIE, Center for Functional Nanomaterials, BROOKHAVEN NATIONAL LABORATORY — Mg and B_4C mixtures (molecular ratio of [1:2]) were reacted in a single step in stainless steel from 850 $^\circ$C to 1300 $^\circ$C to produce nominal $MgB_{1.8}C_{0.2}$ as estimated from unit cell volumes. Reactions from 850 to 1100 $^\circ$C produced an inhomogeneous superconducting phase despite the initial atomic B_4C compound, suggesting that carbon segregation is an important part of these reactions. For reactions above 1100 $^\circ$C, the critical temperature T_c increased from 18 to 28 K as the strain (as estimated from x-ray diffraction peak broadening) decreased at nominally constant carbon content, suggesting that structural order is also important. These changes will be discussed with regard to the formation and coarsening of amorphous and crystalline impurity phases observed by electron microscopy, which affect electron scattering and connectivity. Since only scattering affects the upper critical field, whereas both scattering and connectivity affect the transport properties, optimization of these reactions is crucial to understanding the potential for $Mg(B,C)_2$ as a high-field superconductor.

[1]Work supported by the US Department of Energy under contract number DE-AC02-98CH10886.
[2]Present address: NSF MRSEC for Superconductivity Reserach, University of Maryland

L. D. Cooley
Brookhaven National Laboratory

Date submitted: 29 Nov 2005 Electronic form version 1.4