Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Characterization of Elastic and Vibrational Properties of Dense BC_x Nano-Phases Synthesized under High-Pressure and High-Temperature[1] PAVEL ZININ, KATHERINE BURGESS, RUTH JIA, ERIC HELLEBRAND, TAYRO ACOSTA, LI-CHUNG MING, University of Hawaii — We use Raman scattering to study cold phase transitions in the graphitic g-BC_8 phase and graphite under high pressure up to 84 GPa. It is shown that the E_{2g} Raman active mode of graphite (Gpeak) can be detected up to 84 GPa. We demonstrate that (a) there is a phase transition in graphite and in g-BC_8 at 35 GPa and (b) above 35 GPa the graphite and g-BC_8 transform in a high pressure phase, fully sp^3 bonded a-BC_8 phases, Below the phase transition a polynomial fit to the G peak position versus pressure data yielded the following quadratic relation; above 35 GPa it exhibits linear behavior for graphite as well as for g-BC_8 phase. A direct transformation of graphitic phases in the BC_x system with high concentration of boron (1.5 $<$ x 8) under high pressure and high temperature was studied. It was found that graphitic phases transform to new cubic BC_x (c-BC_3, c-B_2C_3) phases in a diamond anvil cell (DAC) at high temperature, 2200 K, and high pressure, 31 GPa. The atomic structure, bonding between atoms, and nanostructure was determined using transmission electron microscopy (TEM), x-ray diffraction and transmission electron microscopy-electron energy-loss spectroscopy (EELS). Elastic properties of the BC_x phases were determined by Laser Ultrasonic and Brillouin scattering techniques.

[1]This work was supported by the U.S. Department of Energy Grant NO. DE-FG02-07ER46408.

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Date submitted: 22 Feb 2013 Electronic form version 1.4