High Pressure-Induced Phase Transition In $\beta$-Ga$_2$O$_3$: in situ Synchrotron X-Ray Diffraction Studies up to 70 GPa

KRISTINA E. LIPINSKA-KALITA, Center for Nanoscale Device Research, Dept. of Electrical and Computer Eng. University of Nevada Las Vegas, PATRICIA E. KALITA, High Pressure Science and Engineering Center, Dept. of Physics, University of Nevada Las Vegas, RUSSELL J. HEMLEY, Geophysical Lab. Carnegie Institution of Washington, Washington DC, CEDRIC L. GOBIN, High Pressure Science and Engineering Center, Dept. of Physics, University of Nevada Las Vegas — A renewed interest in $\beta$-Ga$_2$O$_3$ has arisen since it has potential applications in optoelectronic devices. We performed in situ synchrotron radiation x-ray diffraction studies in a diamond anvil cell on $\beta$-Ga$_2$O$_3$ on compression up to 70 GPa and on successive decompression. The pressure-evolution of x-ray diffraction patterns was consistent with a low-to-high density phase transition. A thermodynamically stable $\beta$-Ga$_2$O$_3$ phase was converted into the $\alpha$-Ga$_2$O$_3$ phase, which is unstable at ambient conditions. The effect of hydrostatic and non-hydrostatic compression conditions on the evolution of the phase transition was also investigated in compression and decompression cycles. This work is the first report of high-pressure investigations of Ga$_2$O$_3$ on compression up to 70 GPa.

$^1$Use of the HPCAT facility was supported by DOE-BES, DOE-NNSA (CDAC), NSF, DODTACOM, and the W.M. Keck Foundation. We acknowledge the support from the U.S. DoE Cooperative Agreement No. FC08-01NV14049 with the University of Nevada Las Vegas.

Kristina E. Lipinska-Kalita
Center for Nanoscale Device Research, Dept. of Electrical and Computer Eng. University of Nevada Las Vegas

Date submitted: 15 Jan 2006
Electronic form version 1.4