Abstract Submitted
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X-ray diffraction study of laser-shocked forsterite (Mg_2SiO_4) from 20-130 GPa[1] D. KIM, E. BERRYMAN, S. HAN, T. DUFFY, Princeton, S. TRACY, Carnegie Institution, A. GLEASON, Stanford, C. BLOME, LANL, K. APPEL, M. SCHOELMERICH, European XFEL, V. PRAKAPENKA, Uni. of Chicago, H. LEE, B. NAGLER, SLAC, R. SMITH, M. AKIN, J. EGGERT, LLNL, P. ASIMOW, Caltech — Forsterite, Mg_2SiO_4, is of fundamental importance for geophysics as the magnesium end-member of the olivine $(Mg,Fe)_2SiO_4$ solid solution. Interest in the dynamic behavior of olivine is motivated by understanding the nature of shock-induced phase transition in silicates during hypervelocity collisions. While it is known from gas-gun experiments that olivine transitions to a high-pressure phase under shock compression, there are few constraints on the structure of the high-pressure phase. We have carried out an *in situ* x-ray diffraction study of laser-shocked polycrystalline and single-crystal (a-, b-, and c- orientation) forsterite from 20 GPa to 130 GPa using the Matter in Extreme Conditions beamline of the Linac Coherent Light Source. Consistent with earlier gas-gun experiments (Newman et al., 2018), we observe forsterite III, a metastable structure of Mg_2SiO_4, from 50 to 110 GPa. When compressed above 110 GPa, forsterite III undergoes amorphization. Our results show a reversion to the ambient forsterite structure during release over nanosecond timescales.

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