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Dynamics of structural transitions in SiO2 and implications for mineralogy of impact craters ARIANNA GLEASON, CINDY BOLME, Los Alamos National Laboratory, JAMES HAWRELIAK, Washington State University, HAE JA LEE, BOB NAGLER, ERIC GALTIER, LCLS, SLAC, WENDY MAO, GES, Stanford University — Phase transitions in SiO2 at high pressure/temperature are of paramount importance to geophysics. We present experiments performed at the Matter in Extreme Conditions end-station at the LCLS, SLAC showing time-resolved X-ray diffraction (XRD) data of shock compressed quartz and fused silica transforming to stishovite on compression. These data are contrary to some studies concluding that a dense amorphous phase, rather than crystalline stishovite, forms along the SiO2 Hugoniot. XRD snap-shots of this reconstructive phase transition show single-crystal quartz undergoes an intermediate amorphization stage prior to crystallizing into stishovite - revealing the transformation pathway. On shock release, we observe the transformation of stishovite to an amorphous phase as evidenced by in situ XRD at long delay times and ex situ in recovered material. Interestingly, shock recovery experiments, or impact-metamorphosed natural samples, find only trace amounts of stishovite with a relative majority of densified (diaplectic) glass. Therefore our new data showing stishovite forming on compression up to applied pressures of 40 GPa and constraining the formation of glass to the release path are important clues to unraveling the impact history of Earth and the solar system.

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