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In situ observation of stishovite formation in shock-compressed fused silica SALLY JUNE TRACY, Princeton University, STEFAN TURNEAURE, Washington State University, THOMAS DUFFY, Princeton University — Silica, SiO_2, has widespread applications ranging from optical components to refractory materials and is of geological importance as one of the major oxide components of the Earth's crust and mantle. The response of silica phases to dynamic loading has long been of interest for understanding the structural evolution of this fundamental oxide. Under shock compression both crystalline quartz and fused silica are characterized by the occurrence of a broad 'mixed-phase region' (15-40 GPa) and a dense, high-pressure phase with much lower compressibility. Despite decades of study, the nature of this transformation and the identity of the high-pressure phase(s) remain poorly understood. In situ x-ray diffraction experiments on shock-compressed fused silica were conducted at the Dynamic Compression Sector of the Advanced Photon Source. The lattice-level structure was investigated through time-resolved x-ray diffraction measurements on samples reaching peak stress ranging from 12 to 47 GPa. Our results demonstrate that SiO_2 adopts a dense amorphous structure in the 'mixed-phase region' and abruptly transforms to stishovite above 34 GPa. These results provide clear evidence that high-pressure crystalline silicate phases can form from amorphous starting materials on the time-scale of laboratory shock experiments.

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