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An atomistic view of zirconium during shock compression and release MARTIN GORMAN, LLNL, CINDY BOLME, LANL, DAVID MCGONEGLE, Oxford University, ARIANNA GLEASON, SLAC, CARL GREEF, LANL, JUNE WICKS, Johns Hopkins University, PATRICK HEIGHWAY, Oxford University, KENNY HULPACH, BENNY GLAM, Princeton University, ERIC GALTIER, HAE JA LEE, SLAC, JON EGGERT, RAYMOND SMITH, LLNL — The group IV metal Zirconium (Zr) is an important material in the nuclear, aviation and biomedical industries due to its low neutron cross section, high-resistance to corrosion and low toxicity. Understanding the structural behavior of Zr at extreme pressures (P) and temperatures (T) has therefore been the subject of considerable theoretical and experimental effort. While Zr has already been the subject of numerous shock compression studies, the characterization of its structural behavior at high P-T conditions has been limited by a lack of lattice level information provided in these experiments. Our understanding of the phase transition kinetics associated with the alpha → omega phase transition has also suffered from the lack of *in situ* structural information. We used both high-quality velocimetry and in situ X-ray diffraction to extend our understanding of the structural and melting behavior of Zr up to 200 GPa. Upon shock release from the high pressure ω phase, our measurements provide an in situ, atomistic view of the $\omega \rightarrow \alpha$ transformation and its kinetics for the first time. This work was performed under the auspices of the US Department of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344

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