Understanding strength and texture in Fe at planetary core pressures and temperatures: insights from laser compression experiments

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Determining the high pressure and temperature behavior of iron (Fe) provides valuable insight into the evolution and dynamics of the Earth's core. Shock compression using lasers can achieve extreme pressure and temperature conditions simultaneously. The duration of the extreme conditions state is on the order of nanoseconds. This is a challenge for in situ measurements of the shocked material's properties. In this work, we shock-compressed polycrystalline iron at the Matter in Extreme Conditions End Station at the Linac Coherent Light Source, SLAC National Accelerator Laboratory and performed in situ X-ray diffraction (XRD) measurements with sub-picosecond time resolution. The final aim of these experiments is the study of stress of texture in Fe under extreme conditions of pressure and temperature. The presentation will highlight the strategies for such experiment and data processing and present our preliminary results.