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Shock-cavity interactions in a shock-compressed polymer medium in the fluid regime EMILIO ESCAURIZA, University of Oxford, NIRMAL RAI, University of Iowa, DAVID CHAPMAN, University of Oxford, JOAO PEDRO DUARTE, Imperial College London, LUKASZ FARBANIEC, LIAM SMITH, JOHN JONSSON, MICHAEL RUTHERFORD, University of Oxford, MARGIE OLBINADO, ALEXANDER RACK, ESRF, H S UDAYKUMAR, University of Iowa, DANIEL EAKINS, University of Oxford, UNIVERSITY OF OXFORD TEAM, UNIVERSITY OF IOWA TEAM, ESRF TEAM — The study of shock-cavity interactions is important for a wide range of applications, from the medical sciences to the development of mixing mechanisms. However, due to constraints posed by optical imaging, observing the phenomenon directly has proven challenging. We present observations of shock-induced collapse in a solid medium through ultra-high-speed radiography, performed at the ESRF synchrotron. The radiography allowed the tracking of the time evolution of sub-surface interfaces during the collapse process. Shock loading of the PMMA cavity targets was achieved through plate impact with a 2-stage gas gun. As the shock strength was well in excess of the yield strength of the solid medium, the collapse shape was typical of a cavity collapsing in a fluid, with the generation of a jet and the formation of toroidal vortices after jet impact against the far cavity interface. The dependence of the collapse time on shock pressure was investigated, revealing a power law relationship. The results showcase the capabilities of high-speed synchrotron radiography for observing sub-surface phenomena in liquid and solid media.

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