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Study of converging reflected shock waves and Richtmyer-Meshkov instability in spherical geometry

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The paper describes experimental results of the convergence of a spherical reflected shock wave from a spherical wall and its induced Richtmyer-Meshkov instability. In order to visualize the shock waves and their interaction with gaseous interfaces in spherical geometry, an aspheric lens shaped transparent test section made of acrylic PMMA was designed and constructed. The test section has 300 mm diameter spherical inner wall and 430 mm aspherical shape outer wall. This test section permits the collimated visualization object beam to traverse the test section parallel and emerge parallel. Spherical shock waves were produced at the center of the spherical cavity by explosion of silver azide pellets ranging from 1.0 to 20.0 mg with their corresponding energy of 1.9 to 38 J. The charges were ignited by irradiation of a pulsed Nd:YAG laser beam. Pressures were also measured at two points on the spherical wall surface. To produce uniform diverging spherical shock waves the pellets were simultaneously ignited on two sides and were shaped. Such a spherical diverging shock wave was reflected from the spherical inner wall of the test section to form a converging spherical shock wave. Gaseous spherical interfaces concentric with the explosion center were produced by soap bubbles filled with He, Xe, and SF_6. The shock wave motion and resulted Richtmyer-Meshkov instability at the interfaces were visualized by using double exposure holographic interferometry and time-resolved high speed video recording. The sequence of diverging and converging spherical shock wave propagation and their interaction with explosion products gas and the intensified mixing of the gases at the interfaces were studied.