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An Experimental Investigation of the Implosion of Cylindrical Shell Structures[1] C. IKEDA, D. WIEGERT, A. WETZEL, X. LIU, J.H. DUNCAN, Department of Mechanical Engineering, University of Maryland — The implosion of gas-filled cylindrical shell structures in a high-pressure water environment is studied experimentally in a 6-foot diameter implosion tank. The models tested were made of aluminum (outer diameter $D = 1.25$ inches, wall thickness $t = 0.029$ inches) and brass ($D = 1.0$ inches, $t = 0.016$ inches). Cylinder length to diameter (L/D) ratios between 5 and 10 were examined. Internally fitted end caps (3/8 inch thick) were used to seal the cylinder. The water-filled implosion tank was slowly pressurized by adding high-pressure nitrogen gas to a small gas ullage space above the water until the model imploded. The resulting pressure waves were recorded at nine positions inside the tank. The motion of the cylinder was recorded by a high-speed digital movie camera at 24,000 frames per second. Preliminary results show that, as predicted by shell stability theory, the ambient collapse pressure increases as L/D decreases. With an L/D ratio of 10, the cylinder flattens out forming two lobes while at $L/D = 5$ a three lobe shape is formed. The ratio of the maximum shock pressure to ambient collapse pressure at a distance of 5 inches away from the cylinder is 0.2857 for the aluminum cylinder (collapse pressure = 280 psi) and 0.1429 for the brass cylinder (collapse pressure = 105 psi). Collapse modes and shock pressures at shorter L/D will be discussed.

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