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An Experimental Investigation of the Implosion of Cylindrical Shell Structures[1] C.M. IKEDA, J. WILKERLING, J.H. DUNCAN, University of Maryland — An experimental study of the physics of the implosion of cylindrical shell structures in a high-pressure water environment was performed. The shell structures are filled with air at atmospheric pressure and the implosions occur when the water pressure is raised above the shell buckling stability limit. High-speed photography (27,000 fps) was used to observe and measure the motion of the structure during its implosion. High-frequency underwater blast sensors recorded dynamic pressure waves at 13 positions in the tank. The cylindrical models are made from various aluminum alloys (diameter D = 39.1 mm, wall thickness t = 0.89 mm) and brass (D = 16.7 to 25.4 mm, t = 0.33 to 0.36 mm). The ends of the tubes were sealed with Aluminum caps. The pressure records are interpreted in light of the high-speed movies. Cylinder length-to-diameter (L/D) ratios between 6 and 10 were examined; in this range the cylinders implode in a mode 2 cross-sectional shape at pressures between 6.9 and 28.7 bar. It is found that the pressure versus time records from sensors placed at the same dimensionless radial position (r/D) from the cylinder surface scale well with time and pressure scales from cavitation bubble collapse theory.

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