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Confiner-Wall Motion as a Diagnostic in Cookoff Experiments

LARRY HILL, DANIEL HOOKS, TIMOTHY PIERCE, Los Alamos National Laboratory — The use of wall motion as a diagnostic in detonation experiments dates to G.I. Taylor's famous 1941 wartime analysis. A handful of authors (including us) have since used it to analyze the detonation copper cylinder test for equation-of-state information. In addition, we have successfully applied Taylor's analysis to specialized deflagration waves, the behavior of which reasonably mimics that of the detonation copper cylinder test at a greatly reduced rate. Here we present a similar analysis of a miniature deflagration cylinder test, in which the copper tubes simply bulged to a pressure burst. The tube motion was diagnosed with a series of pdv probes, which gave continuous time records at discrete axial locations. We begin by spatially interpolating to obtain continuous records in the axial direction. This allows us to calculate the interior product gas volume at any time, and to generate movies of the tube swelling to rupture. Finally, combining Newton's law with membrane theory, we estimate the gas pressure driving the burst.

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