Experiments on the Ricthmyer-Meshkov Instability with an Imposed, Random Initial Perturbation

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A vertical shock tube is used to perform experiments on the Richtmyer-Meshkov instability with a three-dimensional random initial perturbation. A membrane-less flat interface is formed by opposed gas flows in which the light and heavy gases enter the shock tube from the top and from the bottom of the driven section. An air/SF_6 gas combination is used and an M_s = 1.2 incident shock wave impulsively accelerates the interface. Initial perturbations on the interface are created using two reinforced loudspeakers mounted in the shock tube wall, one near the bottom of the test section and the other near top of the driven section. The two speakers are oscillated out of phase from one another producing the vertical oscillation of the gas column within the shock tube. This motion generates Faraday waves on the interface which result in a small random three-dimensional perturbation imposed on the otherwise flat mixing zone. Planar Mie scattering is used to visualize the flow. Light from a laser sheet is scattered by smoke particles seeded in the air. The laser sheet slices the shock tube trough the diagonal of the square test section in the vertical direction. Image sequences are captured using three high-speed CMOS video cameras operated at a frequency of 6 kHz, which cover the full visualization zone. Measurements of the integral penetration depth are obtained both prior to and following reshock and are compared to existing experimental measurements and models.