

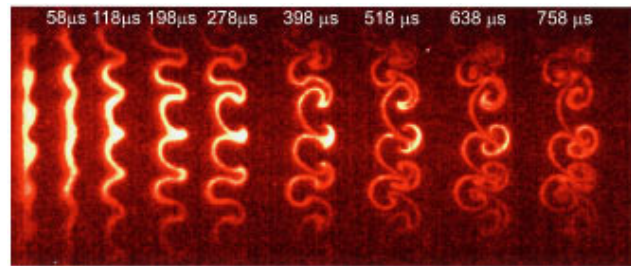
MUSHROOMS AND SNAKES: A VISUALIZATION OF RICHTMYER–MESHKOV INSTABILITY

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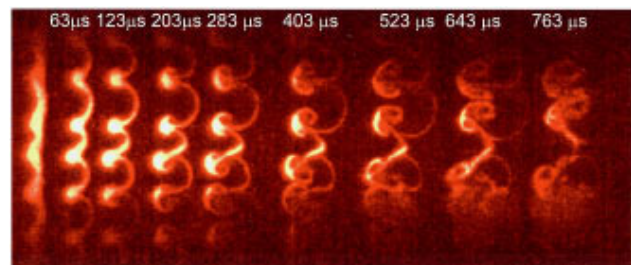
We visualize the Richtmyer–Meshkov instability (i.e., the impulsively driven analog of the Rayleigh–Taylor instability) of a thin layer of heavy gas (SF_6) embedded in a lighter gas (air) and accelerated by a planar shock passing through a shock tube. The heavy gas layer (or curtain) is formed by SF_6 flowing vertically downward into the test section of the shock tube through a varicose nozzle and out of the test section through a slit. Thus, there are no membranes used in producing two diffuse density interfaces on the upstream and downstream sides of the curtain. A horizontal CW laser sheet illuminates the curtain near the mid-plane of the shock tube. An intensified CCD camera records multiple exposures of the shock-accelerated curtain as the latter is swept downstream at the shock piston velocity. This mean motion in conjunction with a variable, intensifier-controlled inter-exposure time allows the acquisition of several images of the curtain on the CCD array during the course of the 1 ms event. In the images shown, the first exposure (left) depicts the pre-shock initial condition of the curtain. The timing of each subsequent exposure (after shock interaction) is shown on the images. Details of the experiment are provided elsewhere.⁶

The images show the three primary flow morphologies seen in previous studies:⁷ upstream and downstream mushrooms as well as the sinuous mode. Within any given cross-stream wavelength, the morphologies correlate with the magnitude of initial perturbation of either the upstream or downstream edge of the curtain. For the first time, this study also shows coexistence of multiple morphologies during the same event. Exact reproduction of the initial conditions during the experiment is difficult due to slow variations in the shape of the curtain prior to shock impact. This study is the first to produce multiple exposures during a single event and to allow quantitative measurement of the growth rate of the instability and its eventual transition to turbulence.

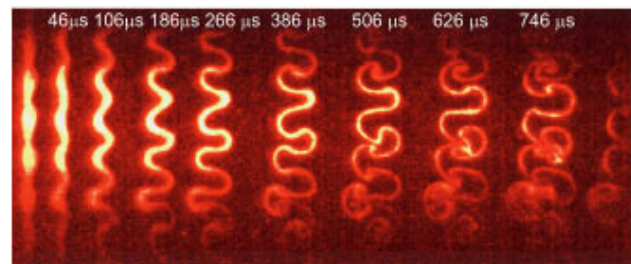
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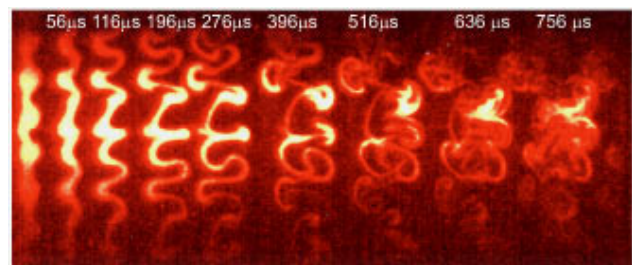
(a) Downstream mushrooms



(b) Upstream mushrooms



(c) Sinuous mode



(d) Coexistence of all morphologies