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Visualization of Shock Wave and Detonation Wave

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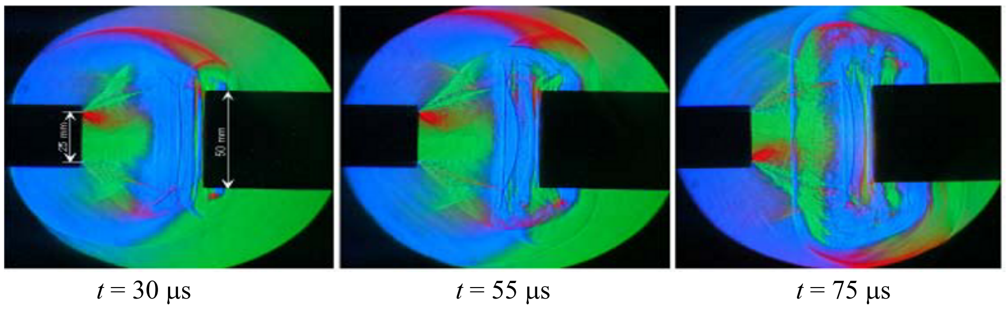

Fig. 1. Sequential color schlieren photographs showing the diffraction and reflection of a shock wave

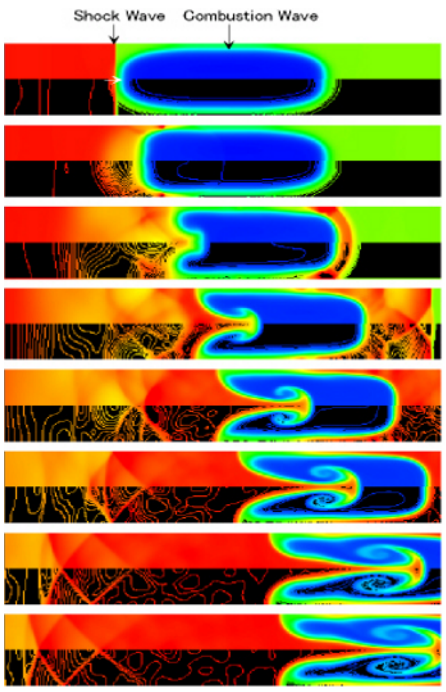

Fig. 2. Numerical simulation of the interaction between a shock wave and a combustion wave

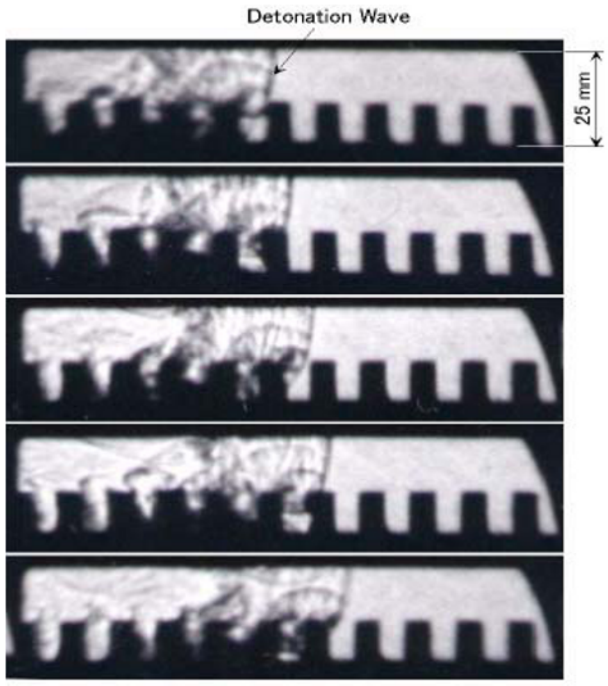

Fig. 3. High-speed schlieren photographs showing the propagation of a detonation wave on an uneven surface

A diffracted shock wave (Mach number, Ms = 3.4) from an open-end pipe of 25 mm in diameter is visualized using the color-schlieren technique (Fig. 1). The shock wave is reflected from a reflector of 50 mm in diameter and shows a complicated flow-field interacting with a secondary shock wave and a contact surface. The interaction of a shock wave and a combustion wave is associated with a mechanism to transit a combustion wave to a detonation wave. Figure 2 shows the result of a numerical simulation showing the behavior of a combustion wave interacting with a shock wave of Mach 1.7.

A detonation wave is a combustion wave propagating with supersonic velocity in a combustible mixture. Figure 3 shows high-speed schlieren images of an oxy-hydrogen detonation wave interacting with obstacles and was obtained using an image-converter camera with an inter-frame time of 5 μs.