

Schlieren Imaging of Laser-induced Ignition and flame propagation by single and successive laser pulses

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Time after
first breakdown

500 μ s

700 μ s

1 ms

1.5 ms

2 ms

3 ms

5 ms

Single laser pulse
23 mJ energy

Hot plume
expansion from
single laser
pulse

Flame front

Nozzle exit

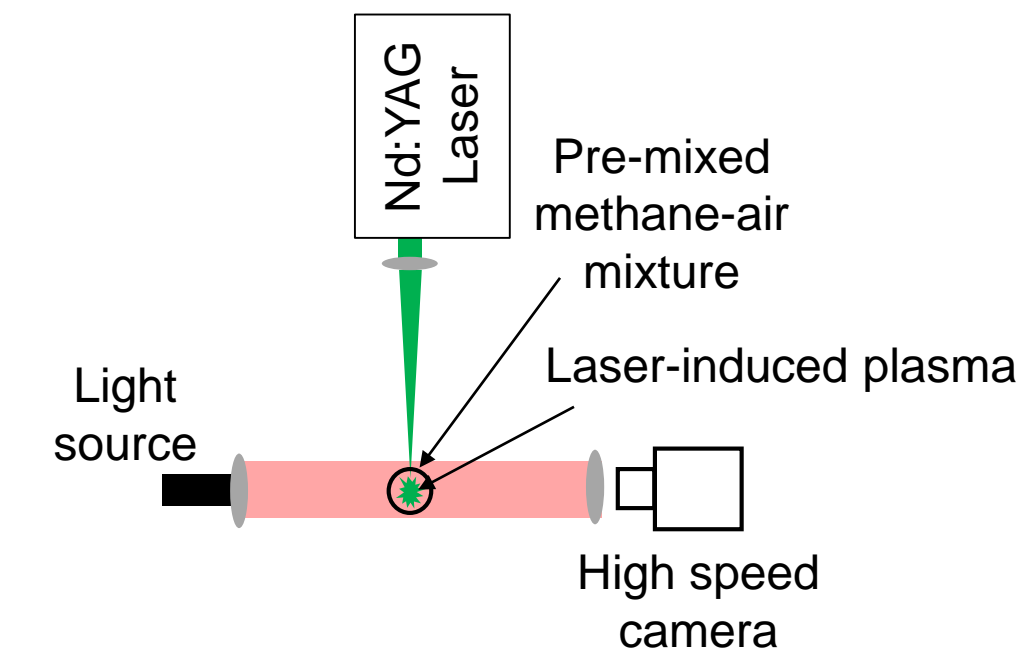
51.5
mm

27.6 mm

Abstract

Schlieren images are shown of laser-induced ignition by a single laser pulse and by successive laser pulses separated by 600 μ s. Laser-induced sparks were produced over a nozzle with 4 m/s stoichiometric methane-air flow. Images were taken perpendicular to the laser beam path. Initially the ignition area for successive laser pulses is much smaller than that of a single laser pulse, but as the two laser pulses interact, they produce a turbulent flame structure which increases flame propagation speed. At 1 ms after the first pulse, the successive laser pulse flame propagation has extended further downstream than single laser pulse flame propagation.

Experimental Setup



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Successive laser pulses
600 μ s between pulses
Laser energy:
1st pulse = 8 mJ
2nd pulse = 15 mJ

Hot plume
expansion from
first laser pulse

Flame front

Second
laser pulse

Interaction between first laser pulse
flame front and the second laser pulse