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High-Speed LIF-OH Imaging of H2-Air Turbulent Premixed Flames

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Abstract : This paper presents a comparative study of effects of the repeated solid obstacles on the propagation of H2-Air premixed flames. Pressure, speed of the flame front as well as structure of reaction zones are studied for hydrogen. Two equivalence ratios are examined for different configurations of three baffle plates and two obstacles with a square cross-section having blockage ratios of either 0.24 or 0.5. Hydrogen fuel mixtures with two equivalence ratios of 0.7 and 0.8 are studied and this is limited by the excessive overpressures. The results show that the peak pressure and its rate of change can be increased by increasing the blockage ratio or by decreasing the space between successive baffles. As illustrated by the high speed images of LIF-OH, the degree of wrinkling and contortion in the flame front increase as the blockages increase. The images also show how the flame front relaminarises with increasing distances between obstacles, which accounts for the pressure decrease with increasing separation. It is also found that more than one obstacle is needed to achieve a turbulent flame structure with intense corrugations.

Keywords : premixed propagating flames, flame-obstacle interaction, turbulent premixed flames, overpressure, transient flames
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