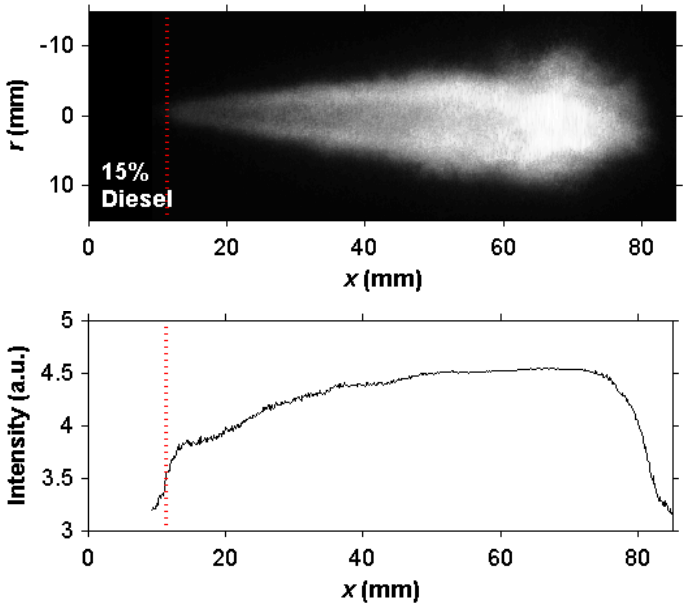
Lift-off length

The flame on a high injection pressure direct-injection (DI) spray under quiescent conditions stabilizes at a location downstream of the fuel injector, and the distance from the fuel injector nozzle to where the flame stabilizes is referred to as the flame “lift-off length”. Flame lift-off allows fuel and air to premix upstream of the lift-off length. Previous studies have suggested that the fuel-air mixture would react immediately in the central region of the spray, downstream of the flame lift-off length. The product gas produced from the reaction zone will then become the feed gas for the remaining downstream combustion processes. The flame lift-off phenomena is an important element of DI diesel spray combustion, as it impacts significantly on the upstream air entrainment process, and hence, the ensuing downstream combustion and emission formation processes. The lift-off length of diesel flame has been shown to be affected by various engine design and operating parameters, including the ambient temperature, gas density, injection pressure, injector orifice diameter and fuel characteristics.



In our chamber, the flame lift-off length is derived from the intensity profile (bottom) of a time-averaged, line-of-sight image (top) that is captured with an intensified CCD (ICCD) camera. The camera is coupled with a UV lens, which is also fitted with a 310 nm band-pass filter. This natural light emission imaging setup enables ultraviolet light, which is emitted by OH chemiluminescence, to be captured. The OH chemiluminescence is used for the determination of lift-off lengths as it is known to occur under high temperature, stoichiometric combustion conditions, such as the flame stabilization location of the diesel lifted flame.

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