

Ignition Time Measurements

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Overview

Conventional shock tube ignition time tests rely on the saturation vapor pressure of the fuel to make the gaseous test mixture. High concentration mixtures of fuels with lower vapor pressures are more difficult to create. Heating can aid in achieving higher fuel loadings; however some fuel cracking or oxidation may result. The aerosol shock tube avoids this issue by using the incident shock wave to vaporize the fuel. Much higher temperatures can be obtained and the evaporation and diffusion times behind the incident shock can be optimized.

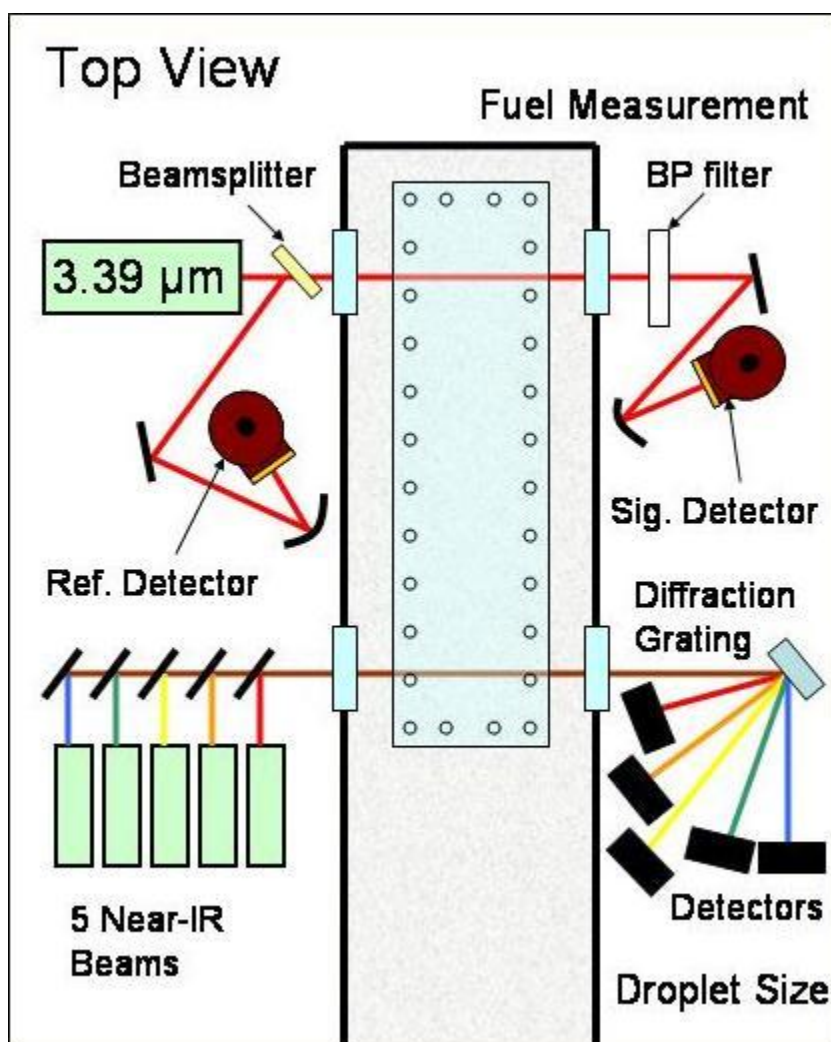


Figure 1: Top view of experimental setup

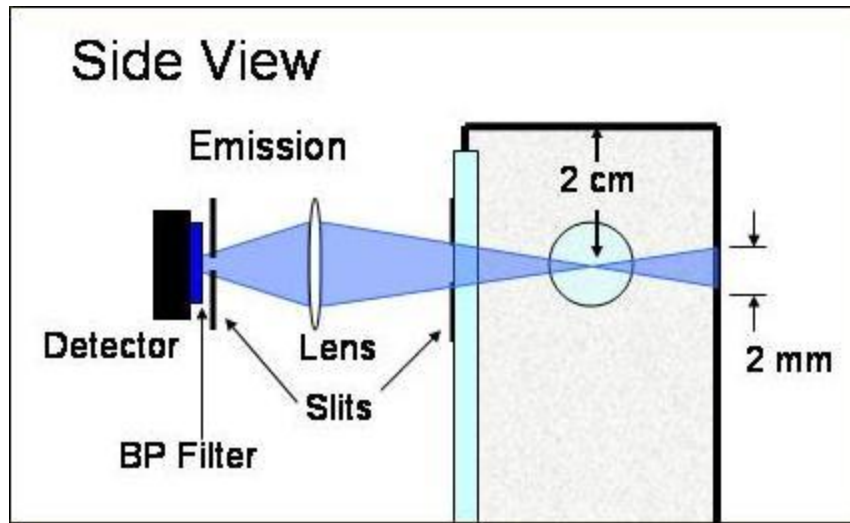


Figure 2: Side view of experimental setup

Measurements of ignition time and species concentration time histories are provided by emission, pressure (PZT) and laser absorption/ extinction. Fuel concentration measurements are made by absorption of 3.39 μm laser light; droplet size and load are determined using multi-wavelength laser extinction generally in the IR.

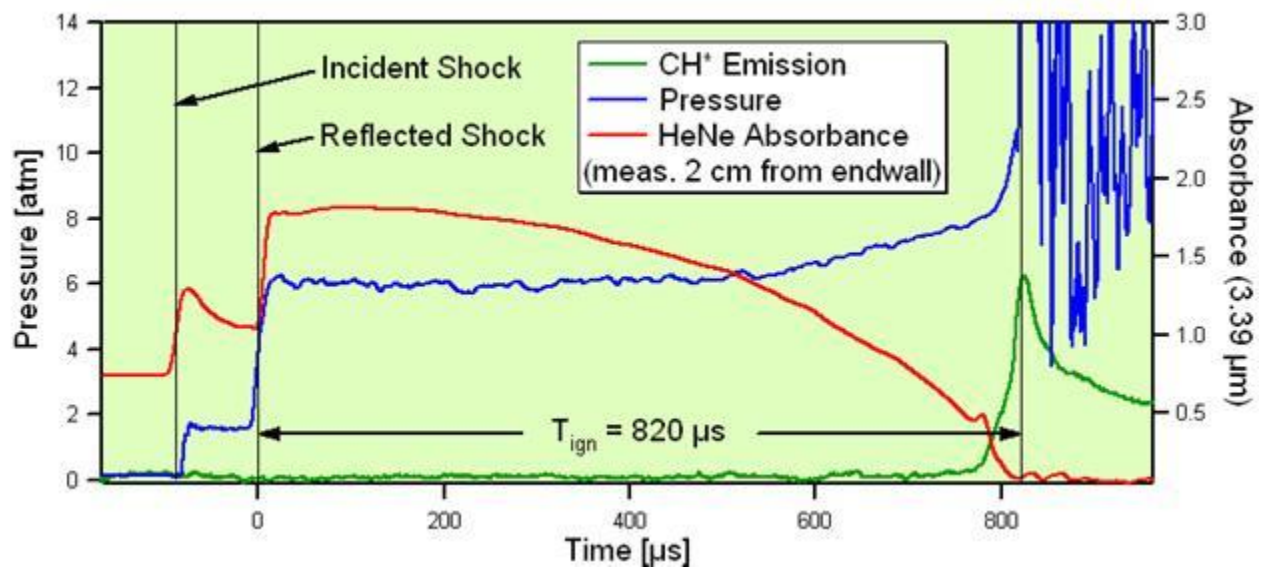


Figure 3: Sample ignition time data measurement

Shown above is the data from a typical ignition time experiment. The ignition delay time (820 μs) can be readily identified in the CH* emission, PZT pressure and 3.39 μm laser absorption signals. Reflected shock conditions: 1122 K, 5.2 atm, dodecane in 21% O₂ /Ar, F=0.5.

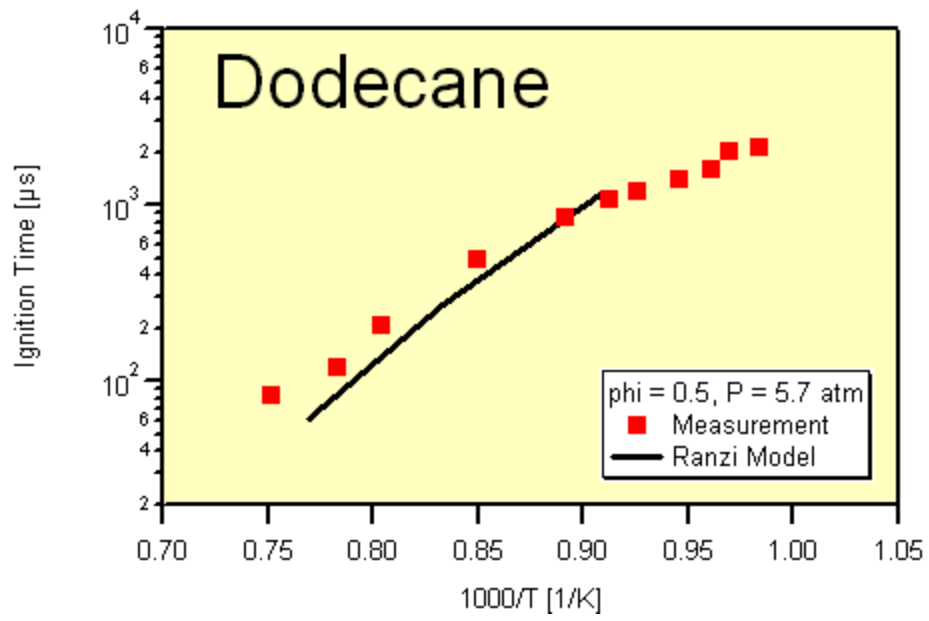


Figure 4: Data comparison

The figure above presents ignition times for dodecane in a mixture of 21% O₂ / Ar. Ignition times are compared to model by Ranzi et al (2006).