



# Spherical Flame Characteristics of Heptane/Iso-Butanol Mixture Droplets

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## Background

### Blending Biofuels with Transportation Fuels

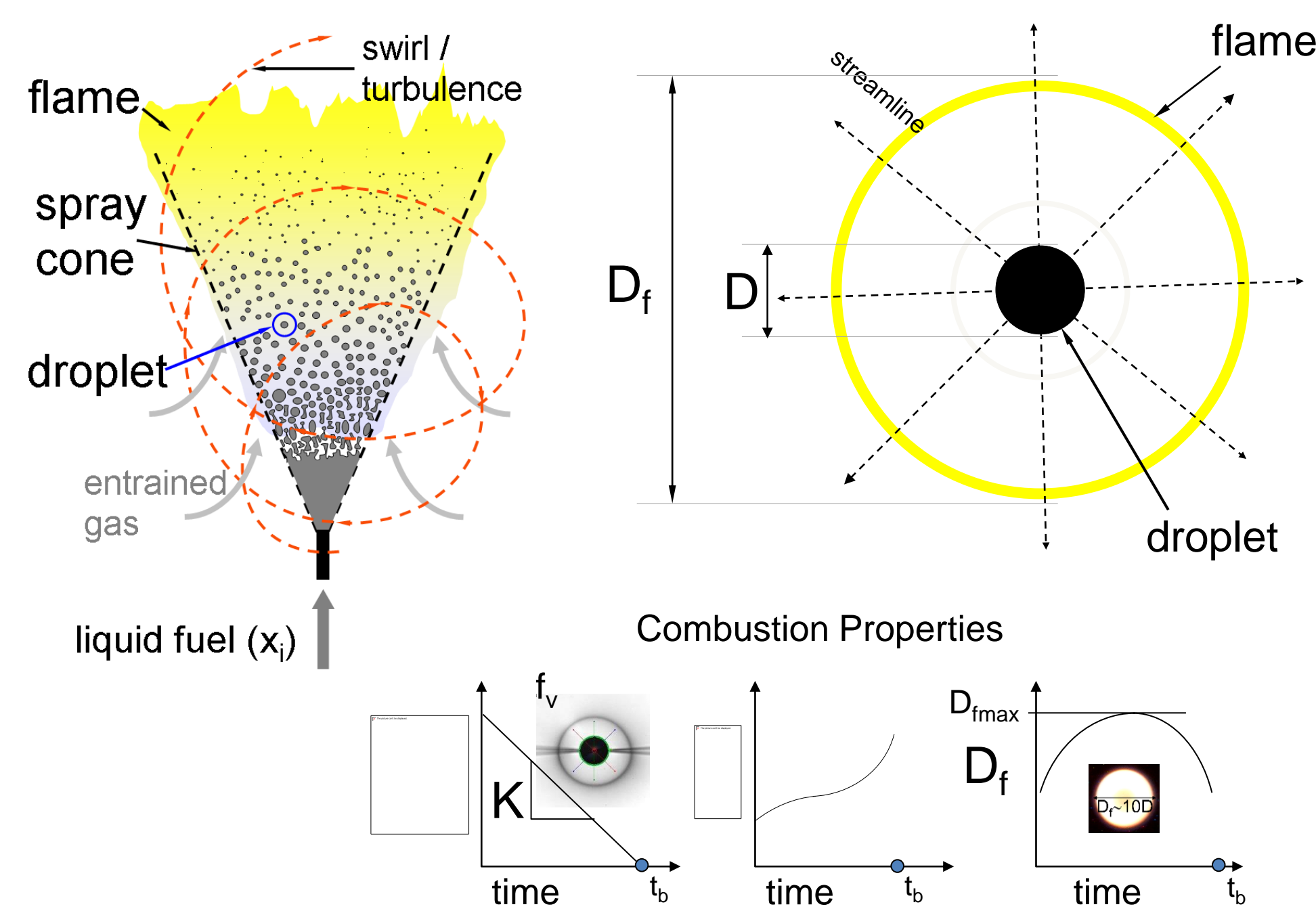
- Biofuels are fuels derived from biological feedstock (eg. ethanol from corn).
- Biofuels are actively being investigated as potential transportation fuel additives largely due to their renewability and their superior combustion properties to ethanol.
- Blending biofuels with transportation fuels can significantly reduce the transportation industry's overall reliance on fossil fuels.
- Purpose of study: identify the combustion characteristics of biofuel and diesel blends.

### Use Surrogate to Model Diesel/Biodiesel Blend

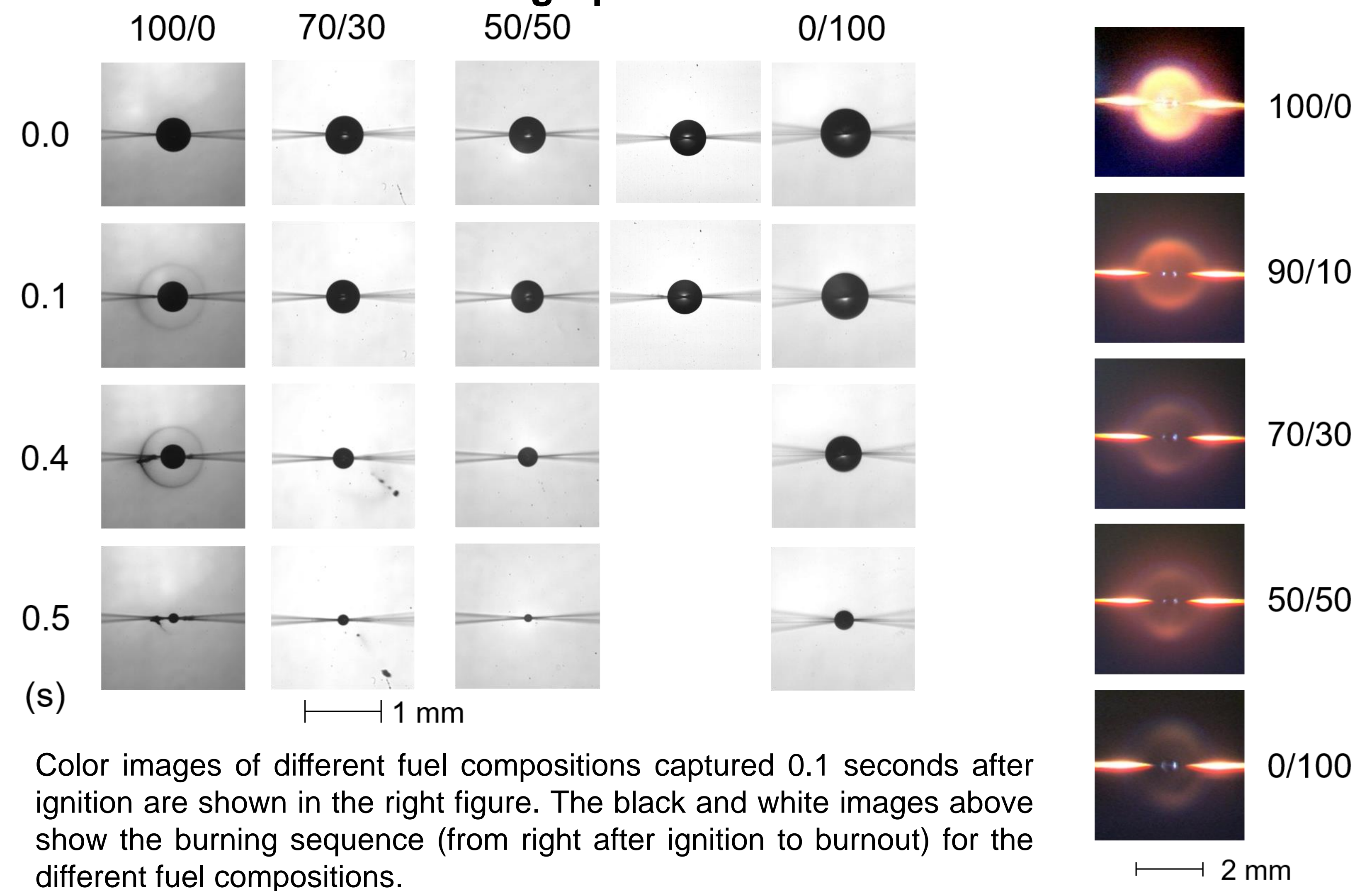
- Gasoline is a multi-component fuel. Heptane is a PRF component for gasoline.
- iso-butanol, a promising biofuel with a high "merit function"

### Combustion Properties from a Single Droplet

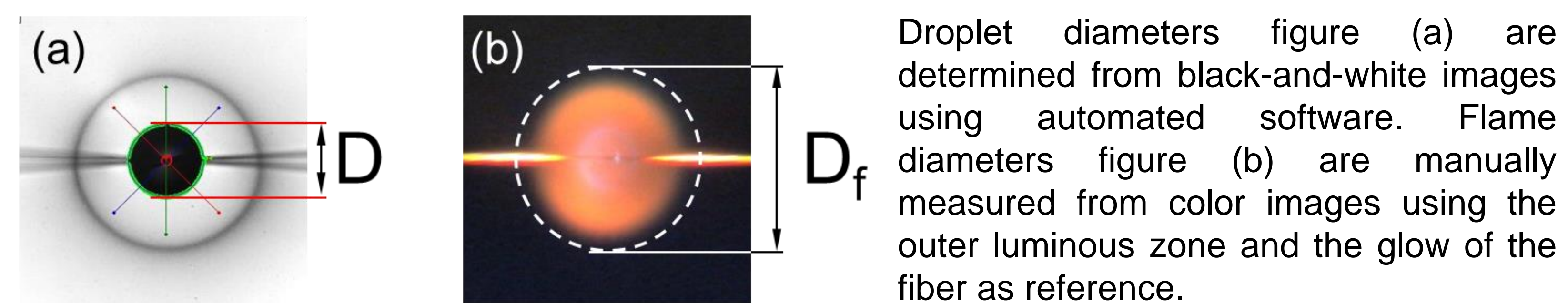
- Sprays are not well controlled environments.
- Consider only a single element of the spray: a droplet.
- Remove convection to create spherical symmetry.
- Extract combustion properties.



## Photographic Observations

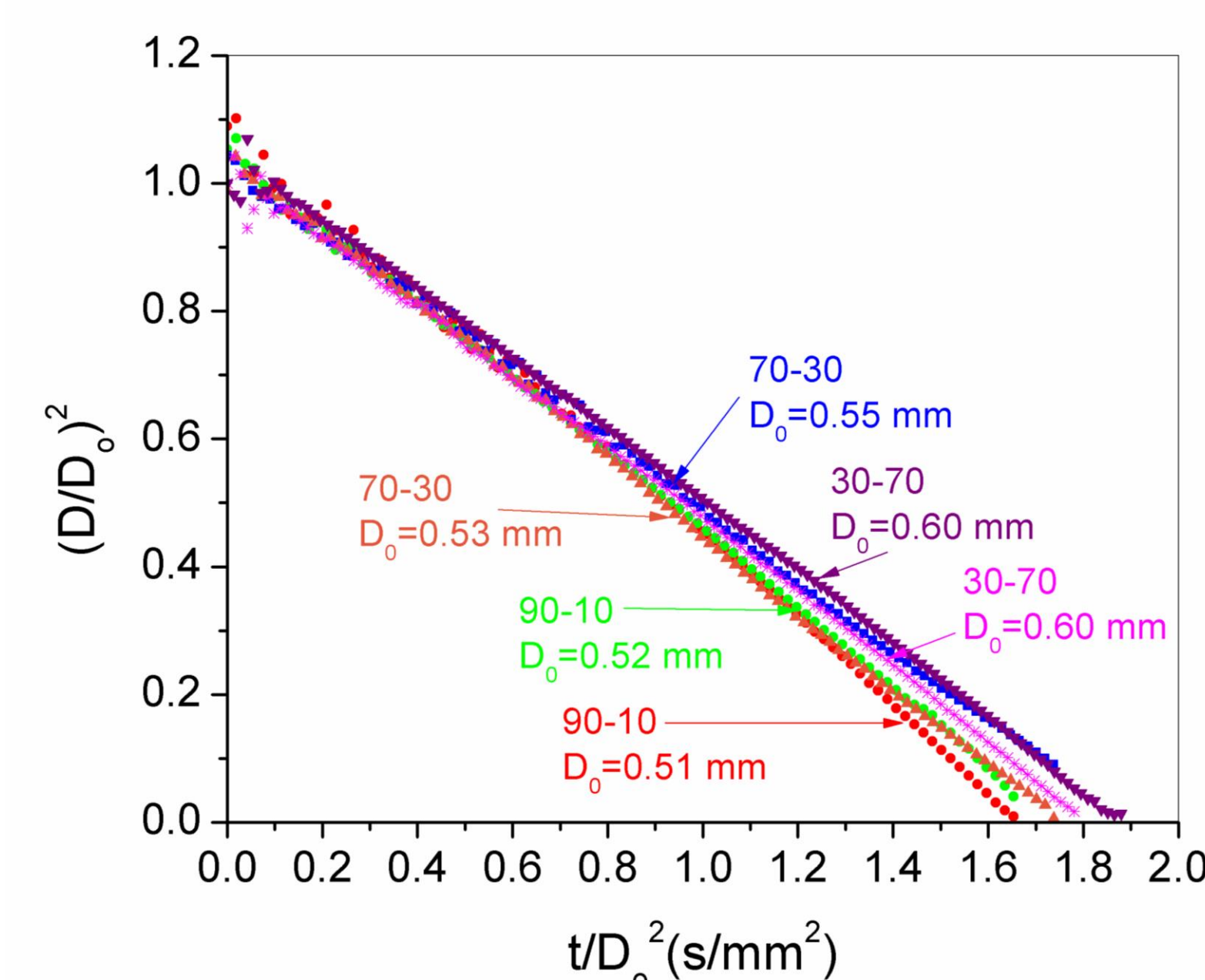


## Image Analysis

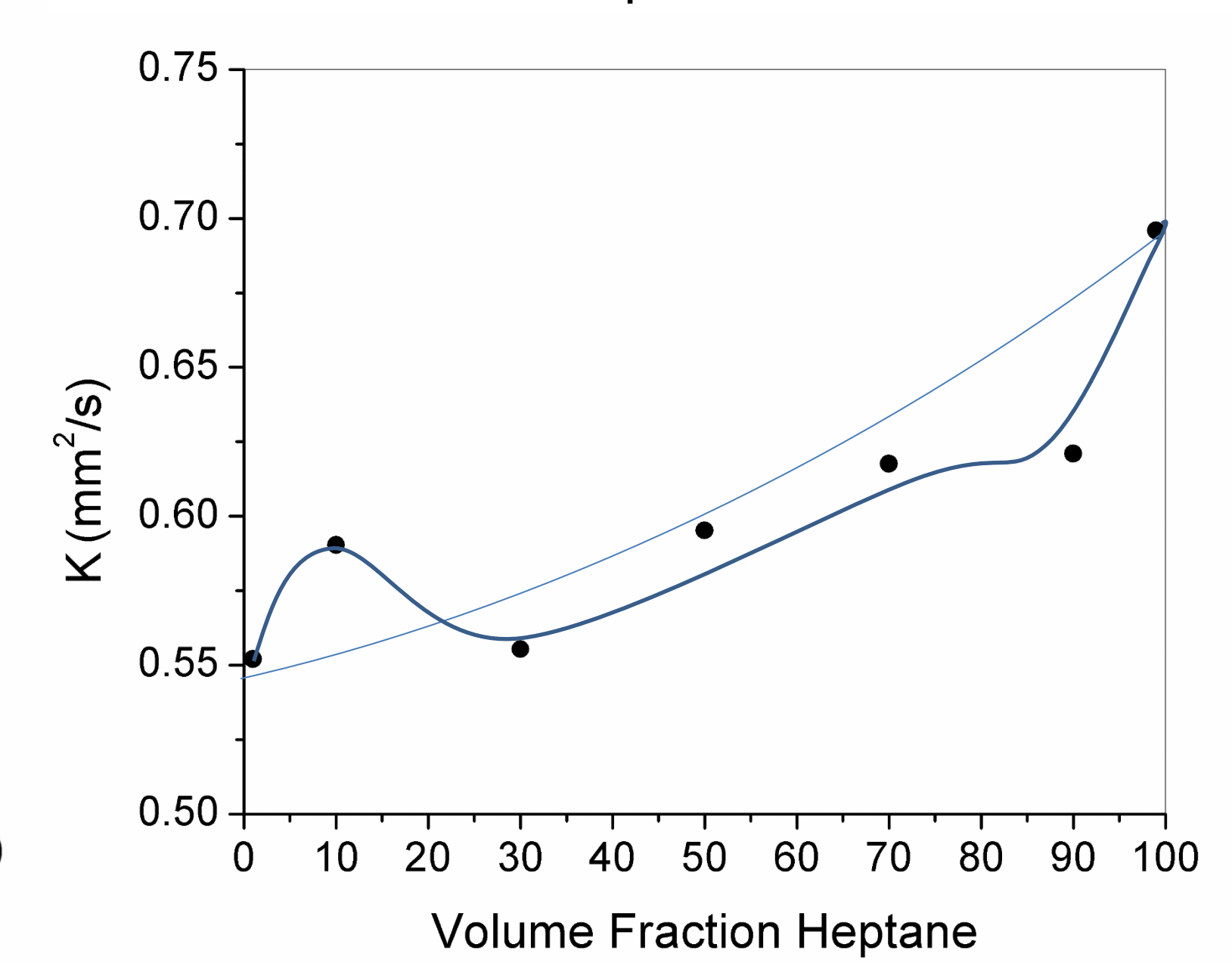


## Quantitative Data

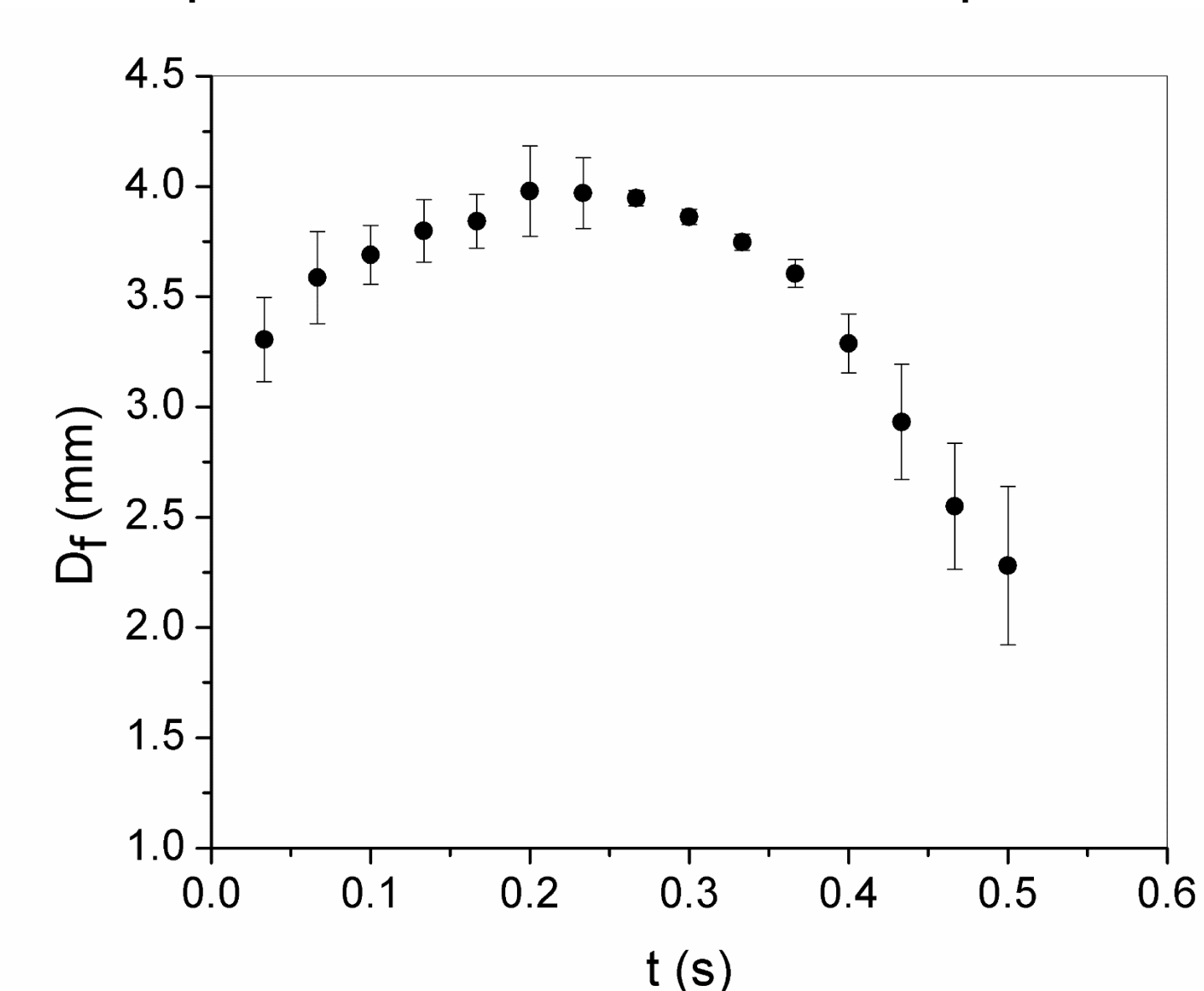
### Droplet Diameter Evolution of Different Fuel Compositions



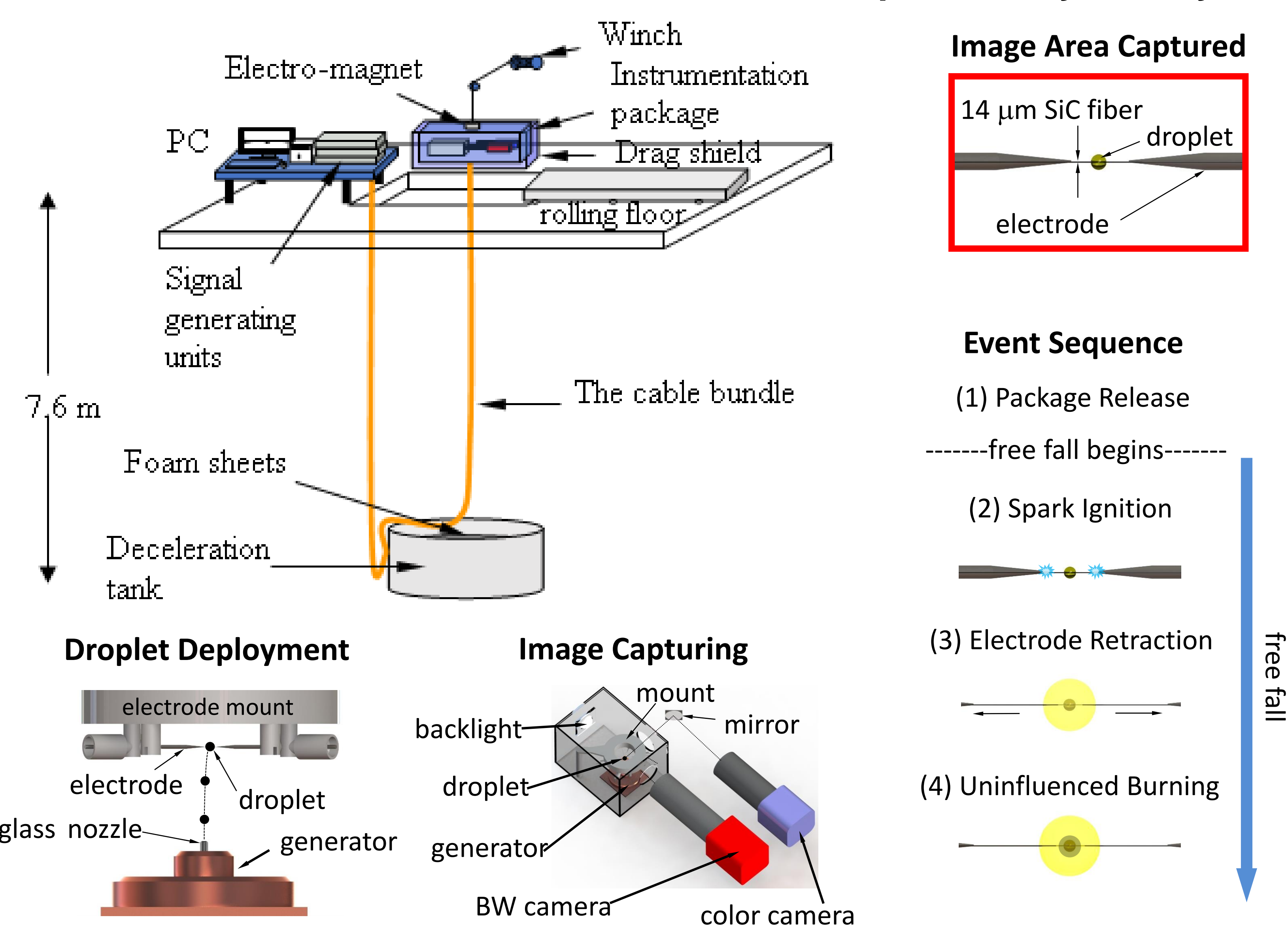
### Burning Rates of Different Fuel Compositions



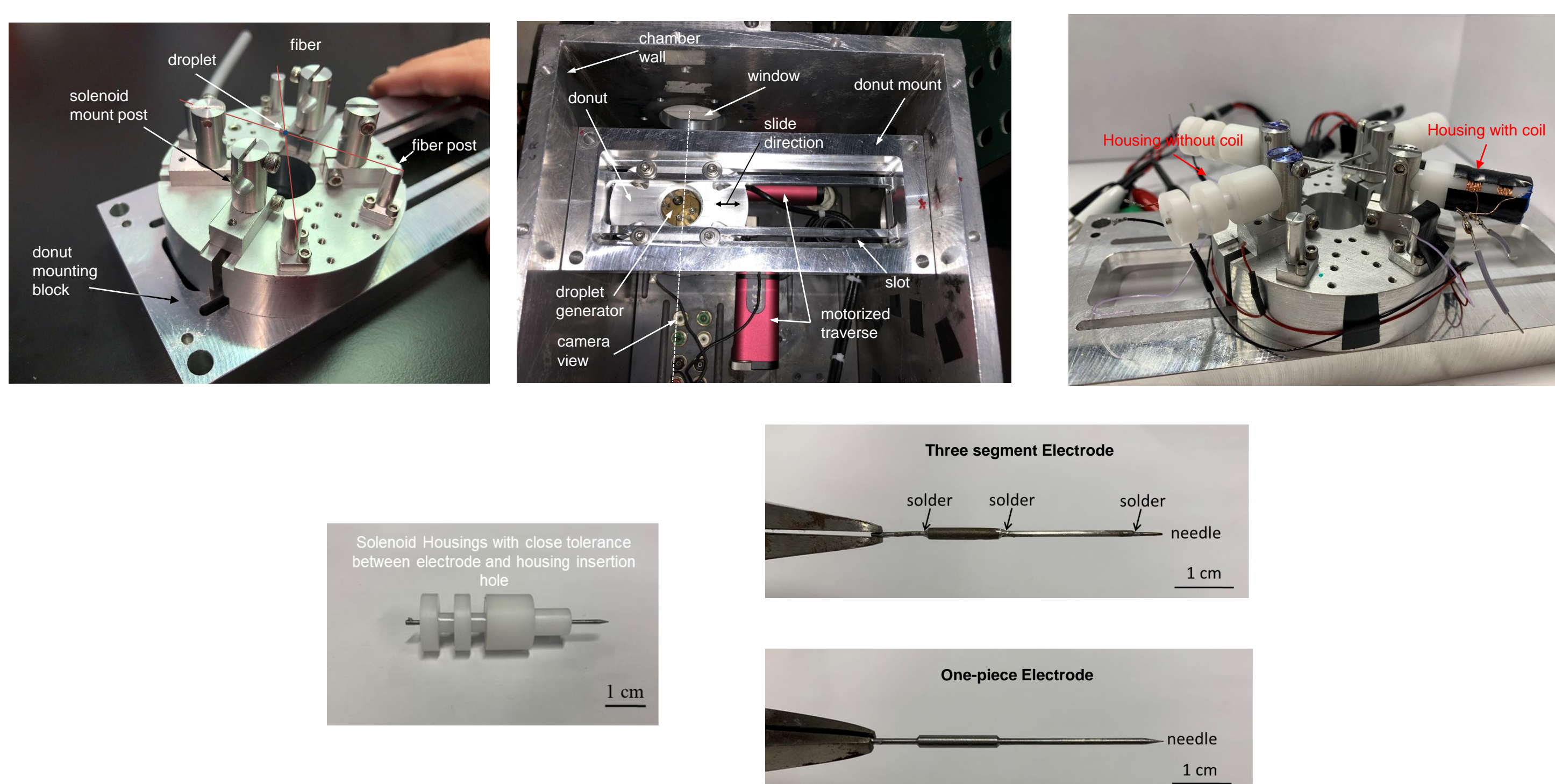
### Flame Diameter Evolution for 70-30 Heptane/Iso-butanol Fuel Composition



## Convectionless Environment to Promote Spherical Symmetry



## Experimental Setup



## Conclusions

- Diluting heptane with iso-butanol reduces sooting propensity, the burning rate, and the relative position of the flame to the droplet.
- All heptane/iso-butanol blends have linear burning rates. Burning rates vary non-linearly between compositions.

## Acknowledgements

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