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An experimental study of the burning characteristics of acetone–butanol–ethanol and diesel blend droplets



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|----|---|
| 2  | butanol-ethanol and diesel blend droplets   |
| 3  | Kai Han*, Bo Pang, Xiaokang Ma, Hao Chen, Guoqian Song, Zhaojing Ni                                     |
| 4  | School of Mechanical Engineering, Beijing Institute of Technology, Beijing, China                       |
| 5  | Abstract  |
| 6  | Acetone-Butanol-Ethanol (ABE), the intermediate product to produce bio-butanol is used as               |
| 7  | an alternative fuel directly to eliminate needless production costs. In this study, the droplet burning |
| 8  | characteristics of neat ABE, diesel and ABE-diesel blends (10%, 20%, 30%, 50% of ABE (vol.%))           |
| 9  | fuels are investigated by the droplet free falling technique under atmospheric pressure. The initial    |
| 10 | droplet temperature and diameter are about 300 K and 235 $\mu m$ respectively. The ambient              |
| 11 | temperature around the flat-flame burner is about 1123 K, and the residual oxygen concentration is      |
| 12 | 21 vol.%. The results show that the addition of ABE not only increases the average burning rate and     |
| 13 | the ignition delay of droplets, but also reduces soot emissions. Meanwhile, ABE-diesel blends           |
| 14 | droplets occur micro-explosion at the end of flame because of the large difference in volatility        |
| 15 | between ABE components and diesel, which distinctly shortens the burning duration of ABE-diesel         |
| 16 | blends. In addition, with the increase of ABE content, the micro-explosion performance and overall      |
| 17 | burning rates increase first and then decrease, which indicates the existence of an optimal volume      |
| 18 | blend ratio around 30% ABE content for ABE-diesel blends that makes explosion performance and           |

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