

Micro-explosion effect of Bio-oil Spray Combustion

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Abstract

Biomass oil is converted from cellulose biomass by thermochemical process. The fuel has low heating value, high moisture and high viscosity multi-component fuel, so it cannot be used alone in existing power equipment. Most will be mixed with fossil fuels. In this study, the spray characteristics of bio-oil blended with kerosene were investigated experimentally. In the combustion of a single droplet, the kerosene droplets of some bio-oil were added to cause micro-explosion phenomenon. Therefore, this study uses synchronous image method. The effects of micro-explosion on the fracture frequency of liquid film and the characteristics of upstream turbulence field were discussed. The results show that adding a low ratios of bio-oil in kerosene changes the frequency of liquid film breakup and the length of liquid film. This is mainly because the kerosene added with bio-oil increases the viscosity and causes the surface tension of the liquid Film and thus change the characteristics of the breakup. In addition, the bio-oil contains a lot of volatile substances and water, so in the emulsified liquid droplets, it is easy to cause a micro-explosion phenomenon. The micro-explosion phenomenon affects the characteristic frequency of the flow field, however, the higher ratio of the bio-oil increases the viscosity of the fuel, and the characteristic frequency disappears. It is shown that adding only the biomass oil below a certain proportion range will affect the characteristic frequency of the flow field. In addition, the jet flow field itself has a low frequency characteristic frequency, and after the addition of the bio-oil, the high frequency characteristic frequency changes due to the micro-explosion phenomenon.

Keynote: Bio-oil, micro-explosion, wavelet analysis, spray combustion, PIV