Development of chemiluminescence sensor for equivalence ratio and temperature measurements in turbulent hydrocarbon flames

鄭藏勝,鄭雅云,趙怡欽,李約亨,吳志勇
Mechanical Engineering
Engineering
tscheng@chu.edu.tw

Abstract

It has been shown that the chemiluminesce emissions of OH*, CH*, and C2*, resulted from electronically excited state, in hydrocarbon flames can be related to chemical reaction rate and heat release rate [1]. The ratios of chemiluminescence of CH*/OH* and C2*/OH* were used to determine local equivalence ratio in laminar and turbulent flames [2, 3]. Most of these chemiluminescence measurements used traditional lenses to collect the global emissions, and there is insufficient spatial resolution to measure the local equivalence ratio at the flame front. To overcome this deficiency, a Cassegrain optics with high spatial resolution must be used [3-5]. In the present study, a Cassegrain optics coupled with an optical fiber and a monochromator is used to simultaneously detect OH*, CH*, and C2* emissions in premixed CH4-air flames. The correlation between the intensity ratio (CH*/OH*, C2*/CH*, and C2*/OH*) and the equivalence ratio and the ratio of C2* emissions at two different vibrational bands are obtained to elucidate the capability of simultaneous measurements of local equivalence ratio and temperature in turbulent premixed hydrocarbon flames.

Keyword：Chemiluminescence Sensor; Local equivalend; Temperature measurement; Hydrocarbon flames