Investigation of the Wall Chemical Effect on Cool Flames

Minhyeok Lee†, Tomotaka Mizuno, Yuji Suzuki
The University of Tokyo
(mlee@mesl.t.u-tokyo.ac.jp†)

Hydrocarbon fuels containing straightly-bonded carbon atoms more than three can form cool flames governed by the low-temperature chemistry (LTC). It has been known that occurrence of the cool flame is responsible for knocking phenomena of spark ignition engines, and autoignition of compression ignition engines. However, fundamental characteristics of the cool flame, which are essentially different from the normal hot flame, remains relatively unexplored, and current LTC models also have to be improved further. Furthermore, wall chemical effects on the cool flame occurred by interaction between the LTC and surface reaction have not been studied yet.
In our previous study, a novel technique to stabilize cool flames was proposed, and formation of the steady cool flame was successfully demonstrated by impinging mixtures of fuel and oxidizer on a heated wall. Under this configuration, the cool flame formed on the wall coated with different surface materials such as silicon dioxide and iron is observed through laser-induced fluorescence (LIF) measurements. In this presentation, we report the wall chemical effect on distributions of the steady cool flame and cool flame ignition behavior.