Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Importance of atomic oxygen in preheating zone in plasma-assisted combustion of a steady-state premixed burner flame K. ZAIMA, Hokkaido University, Japan, H. AKASHI, National Defense Academy, Japan, K. SASAKI, Hokkaido University, Japan — It is widely believed that electron impact processes play essential roles in plasma-assisted combustion. However, the concrete roles of high-energy electrons have not been fully understood yet. In this work, we examined the density of atomic oxygen in a premixed burner flame with the superposition of dielectric barrier discharge (DBD). The density of atomic oxygen in the reaction zone was not affected by the superposition of DBD, indicating that the amount of atomic oxygen produced by combustion reactions was much larger than that produced by electron impact processes. On the other hand, in the preheating zone, we observed high-frequency oscillation of the density of atomic oxygen at the timings of the pulsed current of DBD. The oscillation suggests the rapid consumption of additional atomic oxygen by combustion reactions. A numerical simulation using Chemkin indicates the shortened ignition delay time when adding additional atomic oxygen in the period of low-temperature oxidation. The present results reveals the importance of atomic oxygen, which is produced by the effect of high-energy electrons, in the preheating zone in plasma-assisted combustion of the steady-state premixed burner flame.

Koichi Sasaki
Hokkaido University

Date submitted: 18 Jun 2015 Electronic form version 1.4