Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Hydrogen and Ethene Plasma Assisted Ignition by NS discharge at Elevated Temperatures ANDREY STARIKOVSKIY, Princeton University — The kinetics of ignition in lean H_2:O_2:Ar and C_2H_4:O_2:Ar mixtures has been studied experimentally and numerically after a high-voltage nanosecond discharge. The ignition delay time behind a reflected shock wave was measured with and without the discharge. It was shown that the initiation of the discharge with a specific deposited energy of 10 – 30 mJ/cm^3 leads to an order of magnitude decrease in the ignition delay time. Discharge processes and following chain chemical reactions with energy release were simulated. The generation of atoms, radicals and excited and charged particles was numerically simulated using the measured time – resolved discharge current and electric field in the discharge phase. The calculated densities of the active particles were used as input data to simulate plasma-assisted ignition. Good agreement was obtained between the calculated ignition delay times and the experimental data. It follows from the analysis of the calculated results that the main mechanism of the effect of gas discharge on the ignition of hydrocarbons is the electron impact dissociation of O_2 molecules in the discharge phase. Detailed kinetic mechanism for plasma assisted ignition of hydrogen and ethene is elaborated and verified.

Andrey Starikovskiy
Princeton University

Date submitted: 19 Jun 2015 Electronic form version 1.4