

GEC10-2010-000168

Abstract for an Invited Paper
for the GEC10 Meeting of
the American Physical Society

Physics and chemistry of nanosecond pulsed discharges¹

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Recent decades have seen particular interest in applications of nonequilibrium plasma for the problems of plasma-assisted ignition (PAI) and plasma-assisted combustion (PAC). Starting with a monitoring of the existence/absence of the flame in supersonic flows under plasma excitation, plasma applications arrived at advanced diagnostics, the use of quantitative experimental data and complex kinetic schemes to describe the effect of ignition delay time and ignition length decrease. A great amount of experimental data was accumulated during this period which, for a number of applications, gave rise to the use of low temperature plasma of nonequilibrium gas discharges under the conditions of high speed flows and those similar to automotive engines. The talk reviews the data obtained to date and discusses outstanding problems. The basic possibilities of low temperature plasmas to ignite gas mixtures will be evaluated, and historical references that highlight pioneering work in this field will be presented. Special attention will be given to physics and chemistry of pulsed nanosecond discharges, widely used for PAI/PAC applications.

In collaboration with Andrey Starikovskii, Drexel University, USA.

¹This work was supported by US AFOSR since 1998.