Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Simulations of Thermal Phenomena in Nanosecond Pulsed Plasma Discharged in Supersonic Flows DOUG BREDEN, LAXMINARAYAN RAJA, University of Texas, Austin — The use of nanosecond repetitively pulsed plasmas to ignite and sustain ignition and combustion in supersonic flows has shown promise in recent years. While it is known that radicals produced by the plasma are the primary drivers for enhancing combustion, there is some uncertainty concerning whether radical production is due primarily to electron-impact dissociation or thermal dissociation. We use a self-consistent, multi-species plasma solver is coupled with a compressible Navier-Stokes fluid solver to simulate the temperature field and radical number densities for an H_2-O_2 mixture and pure argon. Temperature increases of $\sim$100-1000 K occur in the cathode near-field region for both mixtures where the electron temperature peaks at $\sim$40 eV in H_2-O_2 and $\sim$20 eV in argon for voltages of -1000 V and -400 V respectively. Radical production of O, H and OH is observed to occur in streamers separate from thermal heating regions. O radicals are seen with number densities as high as 10^{21} cm^{-3}, H densities on the order of 10^{19} cm^{-3} and OH radicals densities of 10^{17}cm^{-3}. From these results, it can be concluded that radical production is due primarily to electron-impact dissociation in the streamers, while thermal effects are due to electron-joule heating in the cathode sheath.

Doug Breden
University of Texas, Austin

Date submitted: 12 Jun 2009 Electronic form version 1.4