Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Simulations of Small-Scale Liquid Film Combustors[1] PAVEL POPOV, WILLIAM SIRIGNANO, University of California at Irvine, Mechanical and Aerospace Engineering — Recent technological advances have generated need for small-scale combustor designs. The reduction of scale, however, leads to a higher area to volume ratio and thus greater relative heat loss. Liquid film combustors are one proposed design which aims to overcome this obstacle. In them, the fuel is injected as a liquid film on the combustor wall, and heat transfer is reduced due to evaporative cooling of the liquid film leading to reduced temperature gradients at the combustor walls. In this work, we present simulation results for a cylindrical small scale liquid film combustor, in which the reactants are liquid heptane and gaseous air. A computational procedure has been developed to simulate this two-phase combustion problem, using detailed chemical mechanisms. A cubic equation of state is applied for the simulation of the gaseous phase at high pressures. The present study examines the structure of the triple flame inside this combustor design, which has been analyzed in previous experimental work. Comparison between simulation and experimental work is made, with particular emphasis on the influence of the chemical mechanism, high-pressure equation of state, and the effect of swirl amplitudes in the liquid and gas phases on the structure of the flame.

[1]Supported by AFOSR grant FA9550-12-1-0156, AFOSR scientific manager: Dr. Mitat Birkan

Pavel Popov
University of California at Irvine, Mechanical and Aerospace Engineering

Date submitted: 01 Aug 2015 Electronic form version 1.4