Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Investigation of pore-scale flow physics in porous media burners

SADAF SOBHANI, PRIYANKA MUHUNTHAN, EMERIC BOIGNE, DANYAL MOHADDES, MATTHIAS IHME, Stanford University, STANFORD UNIVERSITY TEAM —

Porous media burners (PMBs) operate on the principle that the solid porous matrix serves as a means of internally recirculating heat from the combustion products upstream to the reactants, enabling a reduction of the lean-flammability limit, higher power dynamic range, and lower NOx and CO emissions as compared to conventional systems. Accurate predictions of the flow features and properties such as pressure loss in reticulated ceramic foams is an important step in the characterization and optimization of combustion in porous media. In this work, an integrated framework is proposed from obtaining the porous sample to performing a computational fluid dynamics simulation, including X-ray microtomography scanning, digital topology rendering, and volume meshing. Three-dimensional numerical simulations of the flow in the complex geometries of porous foams are obtained by solution of the Navier-Stokes equations using an unstructured, finite-volume solver. This capability enables the investigation of pore-scale flow physics in a wide range of porous materials used in PMBs. In this talk, results obtained at pore-scale Reynolds numbers of order 10 to 100 in a Silicone Carbide foam are presented to demonstrate this capability.

Sadaf Sobhani
Stanford University

Date submitted: 30 Jul 2017 Electronic form version 1.4