ABSTRACT

A significant obstacle to the widespread deployment of hydrogen powered devices is the prevalence of poorly defined and often contradictory safety standards, due in part to a lack of understanding of relevant release, ignition and hazard behavior from unintended releases. The Sandia Hydrogen Safety Codes and Standards program has been tasked with developing validated engineering models that inform Quantitative Risk Analysis (QRA) methods and ultimately guide the creation of defensible safety standards. In this talk, I will describe recent work performed as part of the Hydrogen Behavior subtask to understand leak dispersion from both turbulent free-jet and choked flow releases along with a characterization of release ignitability. Measurements include quantitative Rayleigh scatter concentration imaging, and laser spark ignition coupled with high speed schlieren imaging of ignition and flame light-up processes. These data have been used to develop and subsequently improve reduced order choked flow source models, integral flow dispersion models both within and outside of ventilated enclosures, and detailed consequence modeling of potential hazardous scenarios. The presentation will conclude with a discussion of future work, which includes the model development of flame ignition via electrostatic discharge and sustained flame light-up boundaries for hydrogen releases.

BIO

Isaac Ekoto attended Texas A&M University, where he performed experimental research into supersonic boundary layers. His work improved the fundamental understanding of mechanically strained supersonic turbulent boundary layers at high Reynolds numbers, by expanding the parametric turbulent boundary layer database with high-resolution velocity and surface pressure measurements. Shortly after completing his PhD, he joined the Sandia National Laboratories’ Combustion Research Facility (CRF) in 2007 as a postdoc in the Engine Combustion Group. There he investigated multiphase, reacting, in-cylinder flow fields from automotive diesel engines using advanced optical diagnostics to quantify formation regions of unburned hydrocarbons and carbon monoxide. These data were used to identify dominant physical and chemical processes of high-efficiency, low-emission combustion strategies and subsequently improve engine simulation sub-models. In 2010, he was promoted to Senior Staff and transitioned to the Hydrogen and Combustion Technologies department within the CRF. There he has worked on a variety of projects, which include the refinement of an existing spontaneous Raman diagnostic to distinguish intermediate hydrocarbon species from overlapping C-H/C-C spectral bands and extensive work as part of Sandia’s Hydrogen Safety Codes and Standards program to develop and validate engineering models of dispersion, ignition, and hazard phenomena.

Drinks will be served at 3:45 p.m.