6th International Conference and Exhibition on

Mechanical & Aerospace Engineering

November 07-08, 2018 | Atlanta, USA

Experimental investigation of a lab-scaled flameless combustion system with thermal recuperation

Seyed Ehsan Hosseini, Garrison Phillips, Evan Owens and **Brayden Butler**
Arkansas Tech University, USA

Depletion of fossil fuel resources and increasing rates of pollutant formation have motivated the combustion community to work on combustion efficiency improvement. Recently, flameless combustion systems have been widely developed due to extremely low pollutant formation and fuel consumption reduction in flameless mode. In the flameless regime, the combustion air is highly preheated without increasing the rate of pollutant formation, in particular, NOx emissions. The non-premixed air/fuel is injected into the combustor at high velocities; hence, the availability of oxygen in the reaction zone reduces. In fact, the reaction zone is dispersed throughout the furnace, the hot spots are eliminated and uniform temperature is observed in the chamber. Investigation of combustion stability is still the most important issue in flameless combustion systems. In this regard, the objective of this study is to experimentally investigate the effects of a recuperation system on the stability of a lab-scaled flameless combustion system and the rates of pollutant formation. In this design, fuel is injected axially from one end of the cylindrical-shaped combustion chamber and the air is introduced coaxially from the same side while the flue gases are exhausted from the other end of the chamber. To maintain inside temperature of the chamber over auto-ignition temperature of the fuel, a helical pipe is installed inside the chamber to transfer the fresh air from exhaust zone to burner zone and preheat the combustion air (recuperator). Temperature distribution inside the chamber, wall temperature and the temperature uniformity (considered as one of the most important parameters in flameless mode) are measured. Various radicals inside the chamber are measured to analyze pollutant formation and stability of flameless combustion.

Biography

Seyed Ehsan Hosseini is an Assistant Professor in Mechanical Engineering Department, Arkansas Tech University (ATU) since August 2017. He established a combustion lab named “Combustion and Sustainable Energy Laboratory” (ComSEL) at ATU working on several Combustion and Energy-based projects. Fifteen graduate and undergraduate students are working in various areas of energy and thermofluids (such as alternative fuels, auto-ignition flameless combustion, vortex combustion, mesoscale combustion, phase change material in refrigeration and electrical systems) in ComSEL. His proposal entitled “Meso-scale Vortex Combustion with Thermal Recuperation” was funded by NASA RID on January 2018. Moreover, he has taught Advanced Heat transfer (graduate level), Applied Combustion (both graduate and undergraduate), Heat Transfer, Fluid Mechanics and Senior Design. Before joining ATU, he was a Postdoctoral Researcher Fellow at Combustion and Solar Energy Laboratory, Department of Mechanical Engineering, San Diego State University (SDSU) working on a project funded by Department of Energy (DOE).

shosseini@atu.edu

Notes: