ABDULAFEEZ AKINOLA ADEBIYI$, and V'YACHESLAV AKKERMAN, Department of Mechanical & Aerospace Engineering, West Virginia University, Morgantown, WV, 26506. **Computational studies of oxy-fuel combustion in fired tube boilers integrated with an ion transport membrane.**

Most industrial processes utilize fossil fuels as energy source which produces greenhouse gases and other hazardous emissions. In the U.S., industry generates circa 21% of greenhouse gases, being thereby the major origin for the emissions. . In order to reduce the pollution effects from industrial processes, standard air-fuel combustion is aimed to be replaced by oxy-fuel combustion, which has been identified to have a zero-emission potential. In this respect, an Ion Transport Membrane (ITM) can be used to produce pure oxygen for oxy-fuel combustion. However, adopting an ITM into the reactor of a fired tube boiler has been a major challenge due to the simultaneous oxygen permeation, combustion and heat transfer that occur through the walls of the reactor. For this reason, successful employment of an ITM is of critical importance, and thereby motivates the present work. Specifically, a Computation Fluid Dynamics (CFD) analysis has been carried out on a small-scale fired tube boiler model incorporated with an ITM. The thermal and chemical characteristics of oxy-methane gaseous combustion under constant reactor wall temperature have been investigated. In particular, the reactors performance at elevated temperature has been analyzed. It is observed that oxygen permeation, heat transfer and combustion characteristics can be optimized at elevated temperature of 1373K. Also, increasing the mass fraction of methane in this reactor to 6% facilitates both the heat transfer and combustion in the reactor. At the same time, increasing the mass flow rates of both the air and fuel streams does not impact the reactor performance significantly. This work is supported by West Virginia University's Department of Mechanical and Aerospace Engineering through the Center for Alternative Fuels, Engines and Emissions.