GIDEON UDOCHUKWU and V'YACHESLAV AKKERMAN, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. Reynolds-Averaged Navier-Stokes (RANS) simulation of a staged pressurized oxy-coal combustion (SPOC).

Staged pressurized oxy-coal combustion (SPOC), which is a promising technology being developed at the Washington University at St. Louis (WUSTL) aiming to be used for low-cost, low-emission, high-efficiency power generation, is investigated numerically using the ANSYS Fluent commercial package. The modelling supports the WUSTL experimental endeavors in a 100 kW lab-scale reactor, with 90% of energy coming from the coal and 10% originating from methane-air combustion. To be specific about the burner design, carbon dioxide is injected alongside the coal, for its carriage. In addition, a small amount of methane is also injected alongside the coal to maintain a steady flame. Steady and unsteady Reynolds-Averaged Navier-Stokes (RANS) simulations are performed resulting in an asymmetric flame shape. We propose several potential causes of such a flame asymmetry including peculiarities of the coal injection and the onset of the shear-layer instability occurring because the densities and velocities of the mixing streams. As a result, an influence of the presence of coal on the flame symmetry is demonstrated. In addition, a benchmark at which the further increase of coal would result in flame asymmetry has been found.

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