ANSAN POKHAREL, ALAIN ISLAS, GIDEON UDOCHUKWU, V'YACHESLAV AKKERMAN, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, 26506. Computational Study of Pressurized Oxy-Fuel Combustion of a Multi-phase Medium Comprised of Methane (Fluid) and Pulverized Coal (Solid)

Staged pressurized oxy-fuel combustion is an advanced technology to be employed for the combustion and carbon capturing processes. This technology is promising because of relatively low costs, low emissions and high-efficient power generation with exhausting pressurized carbon dioxide. Our computational combustion group at West Virginia University performs a numerical study of a lab-scale SPOC reactor by using the ANSYS Fluent software for steady and unsteady Reynolds-averaged Naiver-Stokes simulations as well as large-eddy simulations aiming to support the experiments on SPOC ongoing at Washington University in St. Louis,. The simulations consider the total power to be 100 kW, varying the inputs from coal and methane, with CO_2 being the coal carrier. The ultimate computational goal is to continuously reduce the portion of CH_4 and eventually perform the LES of pure coal combustion generating 100 kW without no assistants of CH_4. In present work, the numerical analysis involves a two-phase flow, turbulence, heat transfer as well as the flame and particle dynamics. The species transport model with the finite rate/eddy dissipation turbulence-chemistry interaction is used for coal combustion, along with a non-premixed combustion model for coal-CH_4 burning. The discrete ordinates model for radiation is employed. Being successful with the RANS for pure coal, we are currently on the transition to the LES of pure coal.