SAMUEL OGUNFUYE, ABDULAFEEZ ADEBIYI, V'YACHESLAV AKKERMAN, Department of Mechanical & Aerospace Engineering, West Virginia University, Morgantown, WV, 26506 and Konstantin Kemenov, Symplectic Research Inc., Atlanta, Georgia 30366. Effect of burner geometry on the morphology and propagation of supercritical, CO_2-diluted oxy-methane flames in obstructed channels.

High global demands for energy have promoted innovative research tailored towards exploring novel, more efficient and cleaner power generation. Advanced combustors are a forefront technology being developed in achieving these next-generation energy systems, which can be adapted towards current thermal power plants. One of such promising advanced energy systems technology is utilization of supercritical carbon dioxide (sCO2)-diluted oxy-methane combustion. The present study therefore scrutinizes the effect of the burner geometry, in particular, the role of the blockage ratio α in the propagation and morphology of a CO_2-diluted oxy-methane flame at a supercritical condition in an obstructed channel with 40% CO_2-dilution $(CH_4 + 2O_2 + 1.33CO_2 \rightarrow 2.33CO_2 + 2H_2O)$. The computational simulation of the fully-compressible supercritical reacting flow equations is carried out with various blockage ratios, α = 1/2, 1/3, 2/3, at constant pressure and temperature. It is observed that with an increase in α, the flame propagates exponentially matching earlier works at atmospheric conditions. Also, flame acceleration increases with the channel width. For the α = 2/3 case, high magnitude vortices and shock waves were observed thereby collapsing the concave flame structure observed for α = 1/2 and 1/3 cases.