Chemical kinetic models for supercritical carbon dioxide (sCO2) oxy-combustion have received less attention in the literature and thus this paper aims to develop such a compact kinetic model for a CH4/O2 sCO2 oxy-combustion that is validated against experimental results.

First, we present the development of the reduced and optimized model based on USC Mechanism II. Such a mechanism applies under a range of conditions for pressure (from 150 atm to 300 atm), temperature (from 900 K to 1800 K) and equivalence ratio (from 0.7 to 1.3). Second, the two reduced models are then used in separate simulations of CH4/O2/sCO2 combustion to gage their respective fidelities. Finally, since the chemical kinetic models have large uncertainties under the conditions of interest, a sensitivity study is performed by perturbing the different constants in the models thus elucidating their effect on the simulation results. The proposed studies are performed using a 5-species and 13-species model in a generic jet in crossflow type combustor.