Project (Due 4/17 by email)

Credits (10)

1. Find a combustion kinetic model for the NH_3 laminar flame speed in the literature. Please describe the laminar flame speed measurement method in their work and attach their paper.

2. Calculate the laminar flame speeds of NH_3/air mixtures at pressures (P) of 1, 3, 5, 10 atm, temperatures (T) of 300, 400, 500 K and for fuel-air equivalence ratios (ϕ) of 0.8, 0.9, 1.0, 1.1, 1.2 using CANTERA. You need to plot three figures.
Figure 1: Laminar flame speed at 1 atm and 300 K with a range of equivalence ratios.
Figure 2: Laminar flame speed at 1 atm and $\phi = 1$ with a range of temperatures.
Figure 3: Laminar flame speed at 300 K and $\phi = 1$ with a range of pressures.
Please attach the code and the ".yaml" file.

3. Discuss the effects of temperature, pressure, and equivalence ratio on laminar flame speed results.

Extra Credits (5)

4. Calculate the flame thickness of NH_3/air stoichiometric mixtures at 1 atm and 300 K. Calculate the temperature, heat release rate, and major species (NH_3, O_2, N_2, NO, H_2O) distributions as a function of flame coordinate.

5. Perform a sensitivity analysis of laminar flame speed for NH_3/air stoichiometric mixtures at 1 atm and 300 K. You need to plot the top 5 reactions with positive sensitivity coefficients and the top 5 reactions with negative sensitivity coefficients. Please also attach the code.

Examples can be found using the following links:
https://cantera.org/stable/examples/python/onedim/adiabatic_flame.html
https://cantera.org/stable/examples/python/onedim/flamespeed_sensitivity.html
https://cantera.org/3.1/userguide/ck2yaml-tutorial.html