Metody Komputerowe w Spalaniu - Cantera Project: Adiabatic Flame Temperature of a Mixture of Propane and Oxygen

Krzysztof Górka

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1 Introduction

Adiabathic temperature is the maximum temperature that can be achived for given reactans. For an adiabatical combustion process with no shaft work
the temperature of the products is reffered to as the adiabatic flame temperature.
In this project I am going to calculate adiabatic temperature of a mixture of Propane and Oxygen depending on the concentration of Propane in the Oxygen for different initial conditions.
According to [2] the concentration range of flammability for Propane (in Oxygen) is form 2,3 to 55 percent.

2 Literature

1. http://appmonitor.com/che263/index.php
2. http://fluid.wme.pwr.wroc.pl/ spalanie/dydaktyka/spalanieinstrukcje/ spalanielaborinstrstezeniowegranicepalnoscigazow.pdf
3. http://cerfacs.fr/cantera/mechanism/meth.php

3 Description of a Model

The stechiometric chemical reaction is given:
$C3H8 + 502 \rightarrow 3CO2 + 4H2O$
Reaction is adiabatic so there is no enthalpy loss- $hp = hr$. To know the products temperature i have to solve the problem: $f(Tp) = hp - hr = 0$.
In the beginning I am calculating enthalpy of reactans with temperature of 300K. Then I need to write function for products entalphy and then solve f(Tp) so I get the products adiabatic temperature.
Next I am taking into consideration different ranges of flammability from 2,3 to 55 percent. I am using the excess Oxygen coefficient which varies from 0,225 to

11,678. The variable in my chemical reaction is "a" which is the excess Oxygen coefficient multiplied by 5. I am taking into consideration the case when mixture is fuel-lean or stechiometric: $a >= 1$
Now reaction is given:
$C3H8 + a02 \rightarrow 3CO2 + 4H2O + (a - 5)O2$
In the end I am repeating previous steps for different initial reactans temperature.