

Metody Komputerowe w Spalaniu - Cantera

Project: Adiabatic Flame Temperature of a Mixture of Propane and Oxygen

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1 Introduction

Adiabatic temperature is the maximum temperature that can be achieved for given reactants. For an adiabatic combustion process with no shaft work the temperature of the products is referred 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.

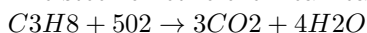
According to [2] the concentration range of flammability for Propane (in Oxygen) is from 2,3 to 55 percent.

2 Literature

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

3 Description of a Model

The stoichiometric chemical reaction is given:



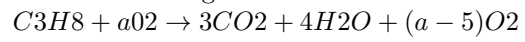
Reaction is adiabatic so there is no enthalpy loss- $h_p = h_r$. To know the products temperature I have to solve the problem: $f(T_p) = h_p - h_r = 0$.

In the beginning I am calculating enthalpy of reactants with temperature of 300K. Then I need to write function for products enthalpy and then solve $f(T_p)$ 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 stochiometric: $a \geq 1$

Now reaction is given:



In the end I am repeating previous steps for different initial reactans temperature.