

WYDZIAŁ MECHANICZNY ENERGETYKI I  
LOTNICTWA

INDIVIDUAL REPORT MKWS

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**PROJECT 1**  
**Combustion parameters for**  
**methane-air mixture**

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*Submitted By :*  
Bogusław Sowa

# Contents

1	Introduction . . . . .	2
2	Variable pressure . . . . .	3
2.1	P=200000 Pa . . . . .	3
2.2	P=400000Pa . . . . .	6
2.3	P=800000Pa . . . . .	9
3	Variable temperature . . . . .	12
3.1	T = 1000 K . . . . .	12
3.2	T = 1200 K . . . . .	15
3.3	T = 1400 K . . . . .	18
4	Variable equivalence ratio . . . . .	21
4.1	$\phi = 0.5$ . . . . .	21
4.2	$\phi = 2$ . . . . .	24
4.3	$\phi = 4$ . . . . .	27
5	Summary . . . . .	30

## 1 Introduction

The goal of this project was to simulate the process of burning a methane-air mixture. Four burning parameters for different initial parameters was calculated on Cantera program.

Burning parameters :

- temperature
- oxygen mole fraction
- methane mole fraction
- hydrogen mole fraction

Initial parameters :

- temperature
- pressure
- equivalence ratio

The experiment was divided for three sections in which two of mixture parameters (temperature, pressure, equivalence ratio ) were constant and one was variable.

The results of calculations are each burning parameters-time dependencies.

## 2 Variable pressure

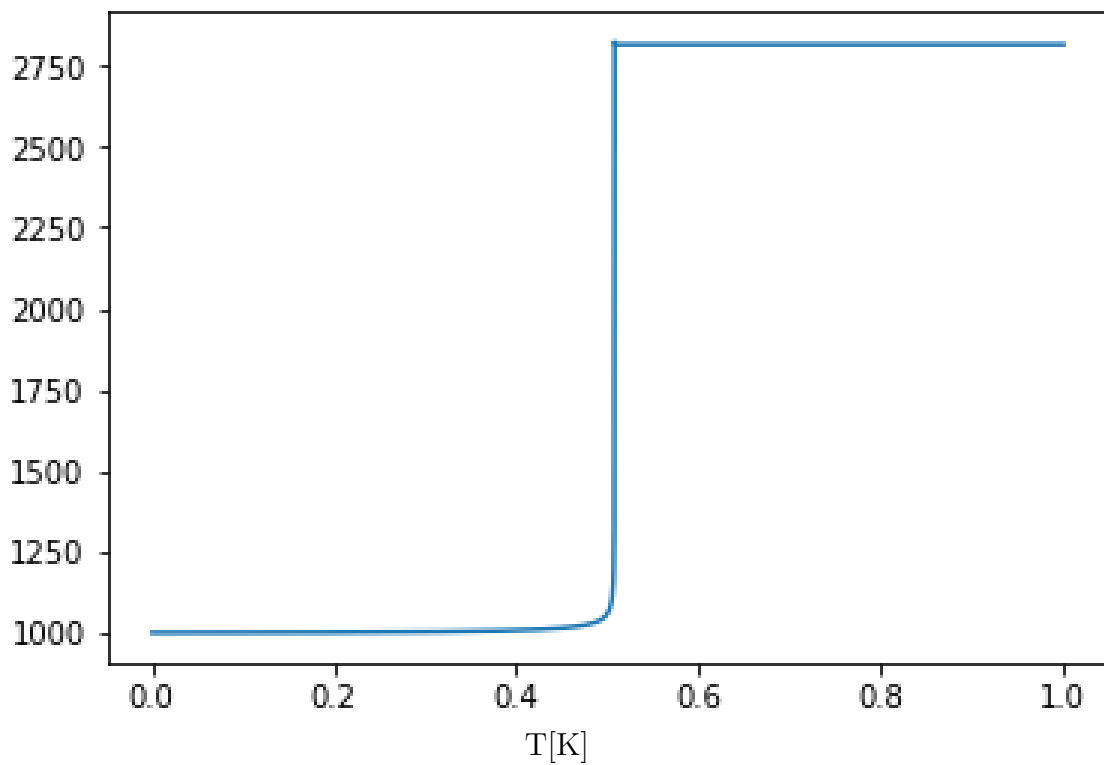
Temperature and equivalence ratio are constant.

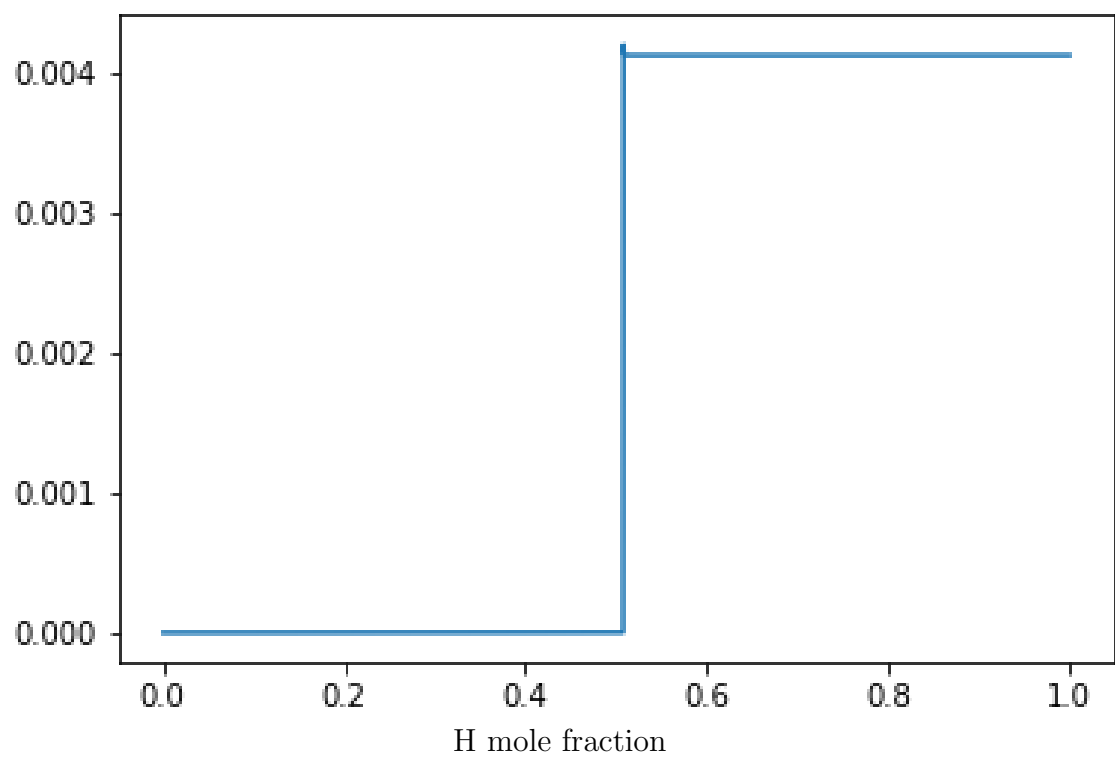
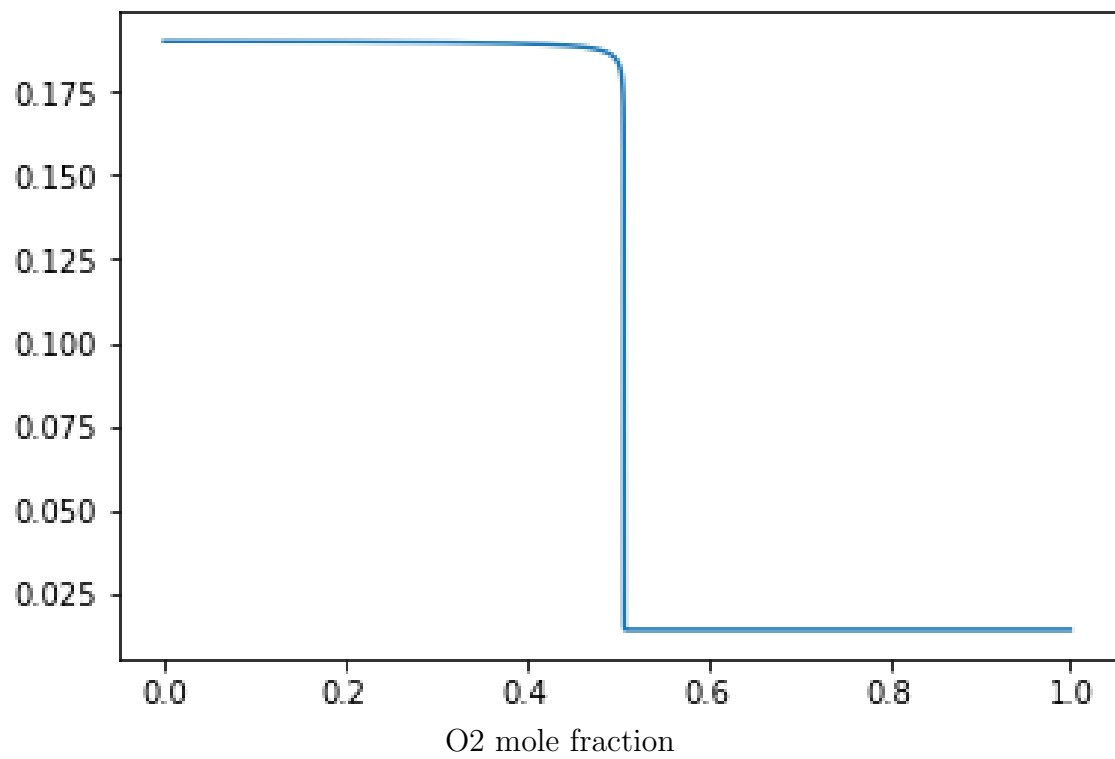
$T = 800 \text{ K}$

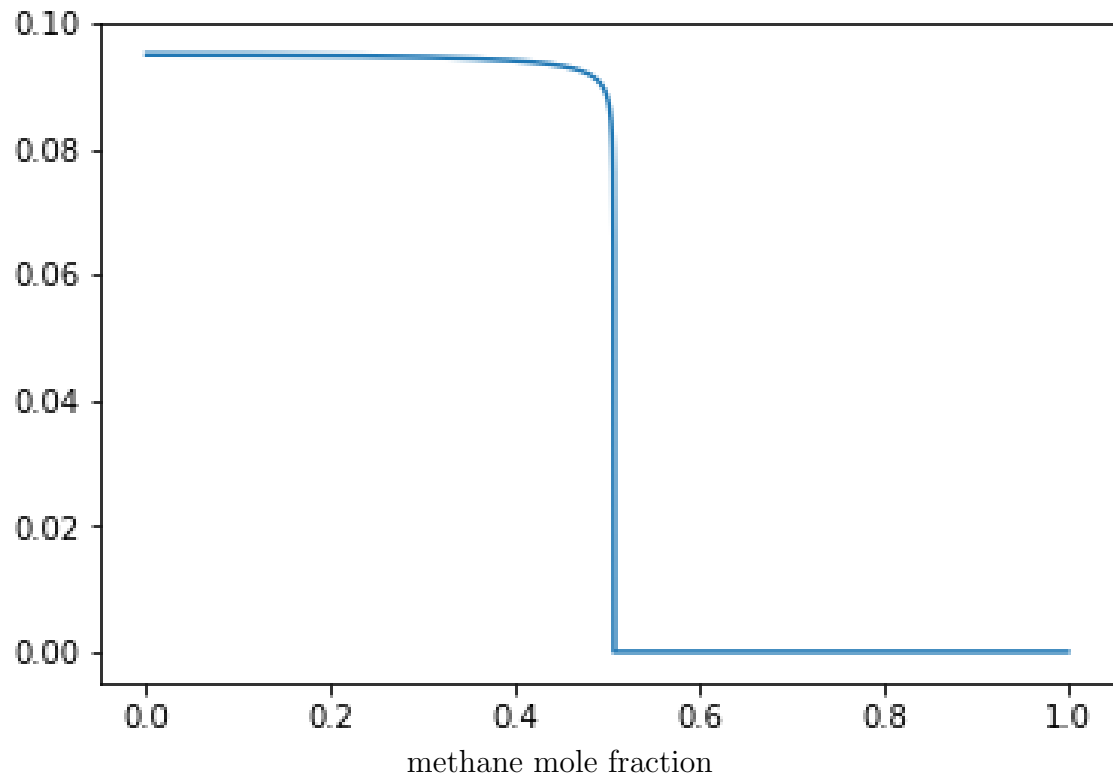
$\phi = 1$

Pressure in this section was variable and equal to three different values.

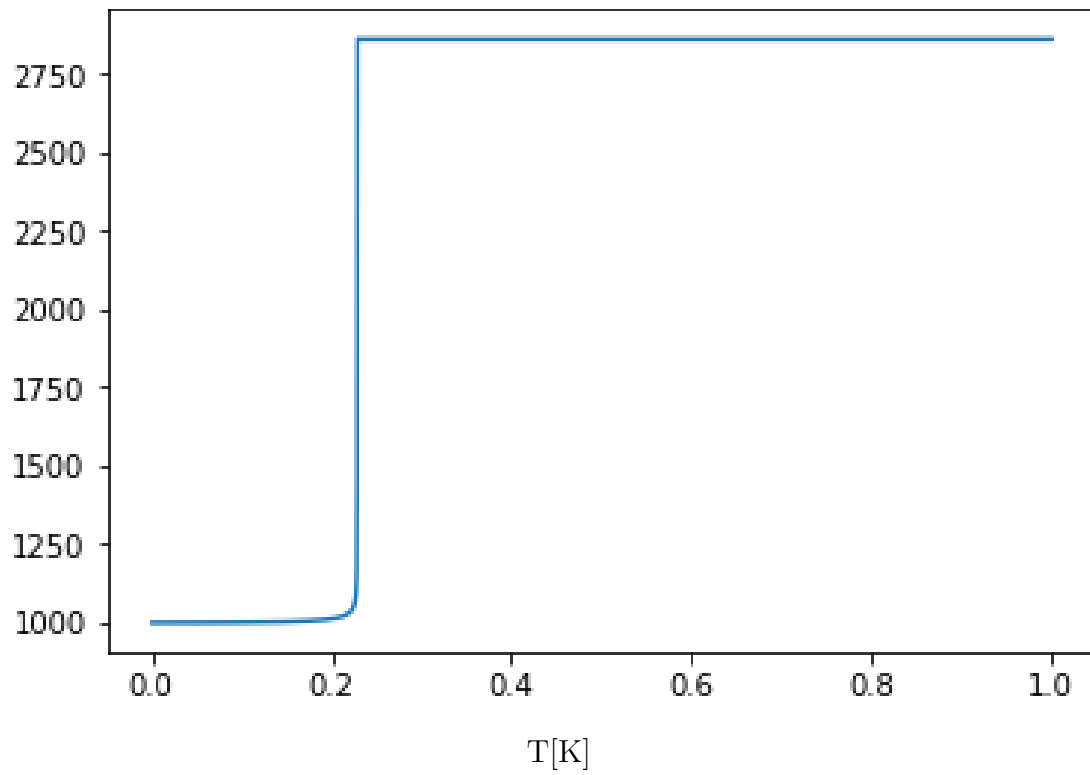
### 2.1 $P=200000 \text{ Pa}$

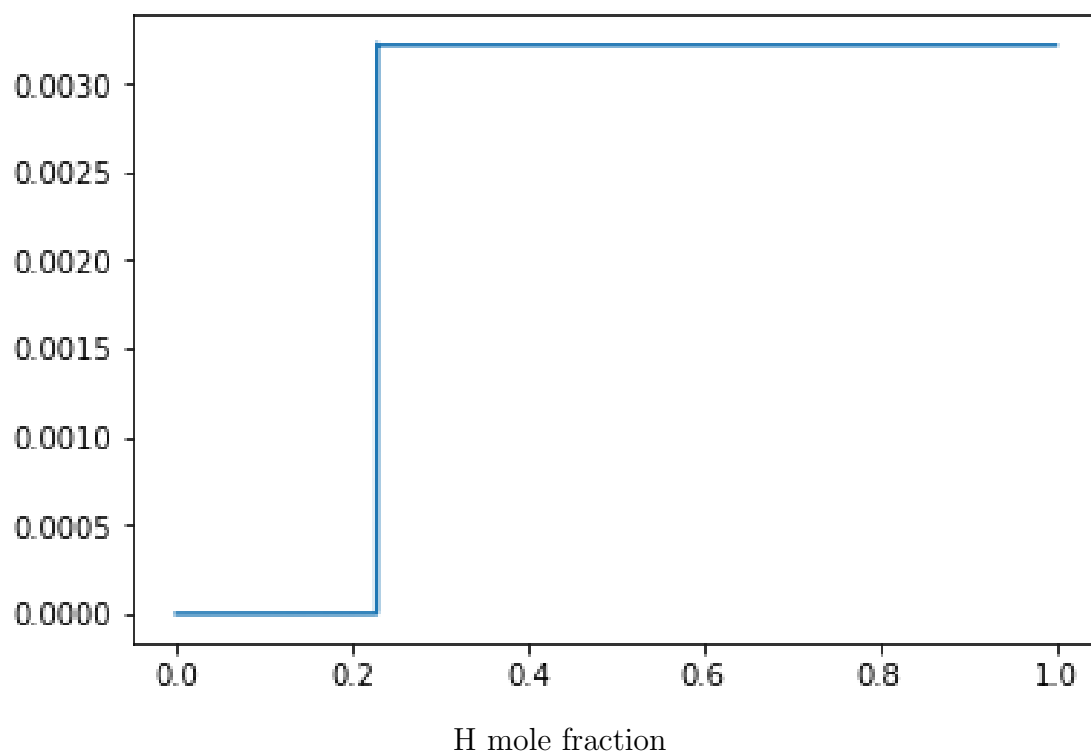
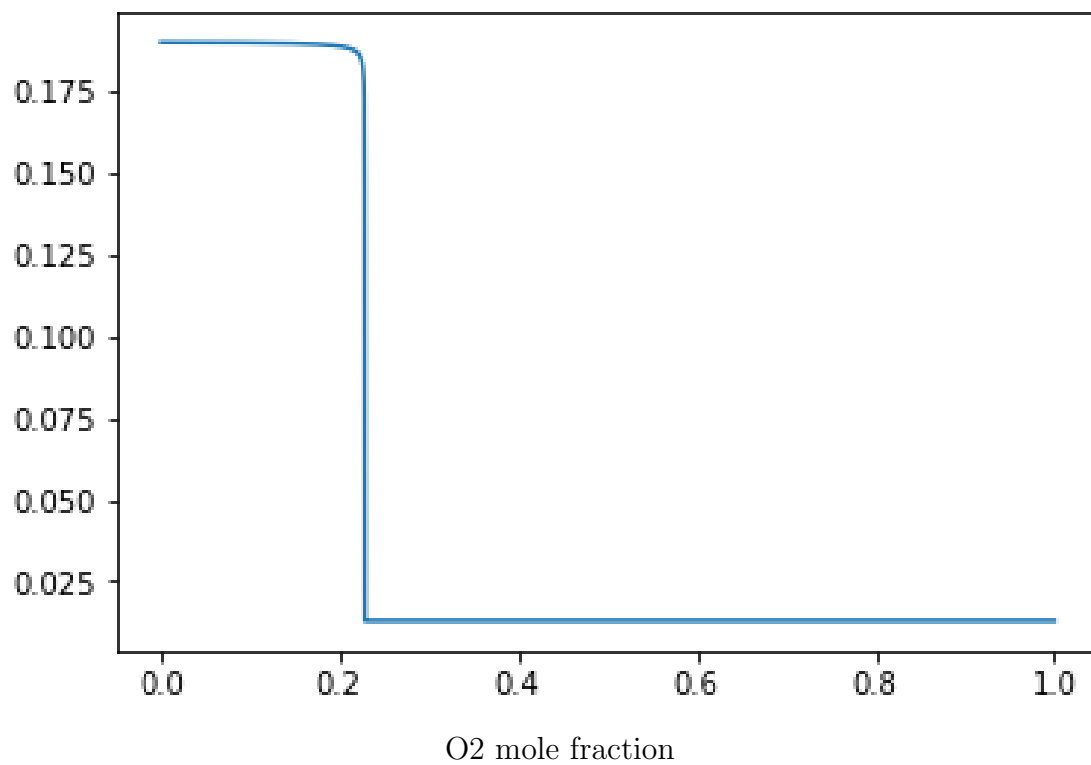




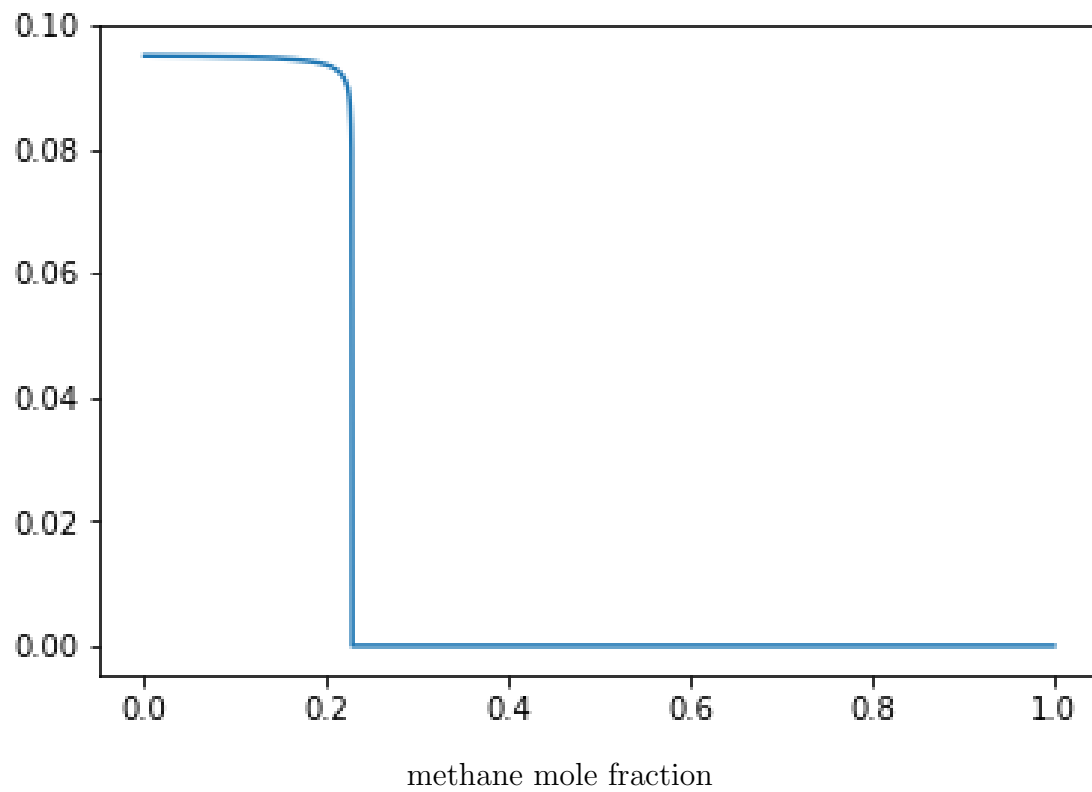


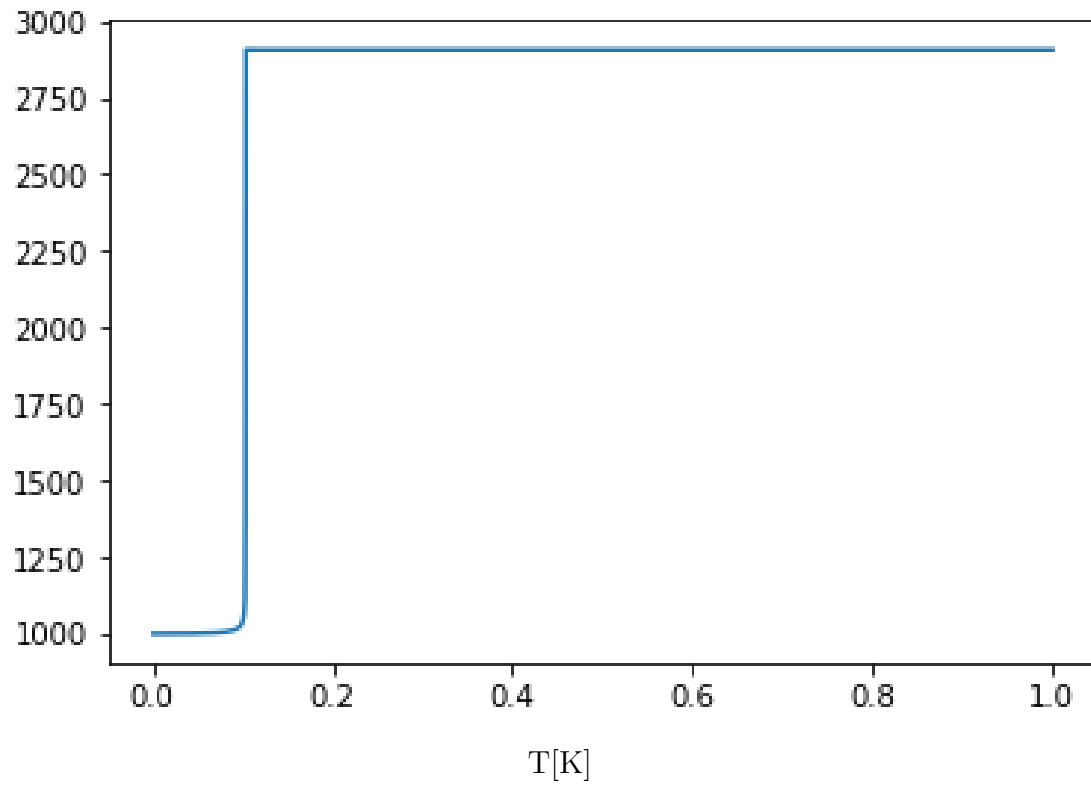
## 2.2 $P=400000\text{Pa}$

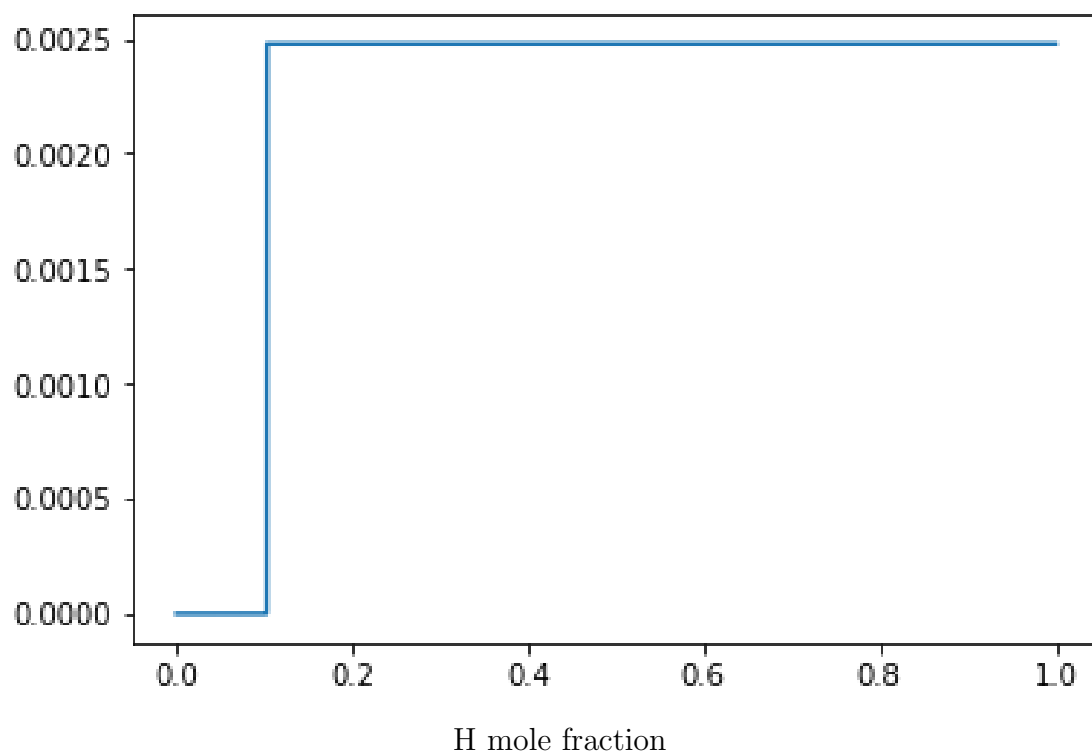
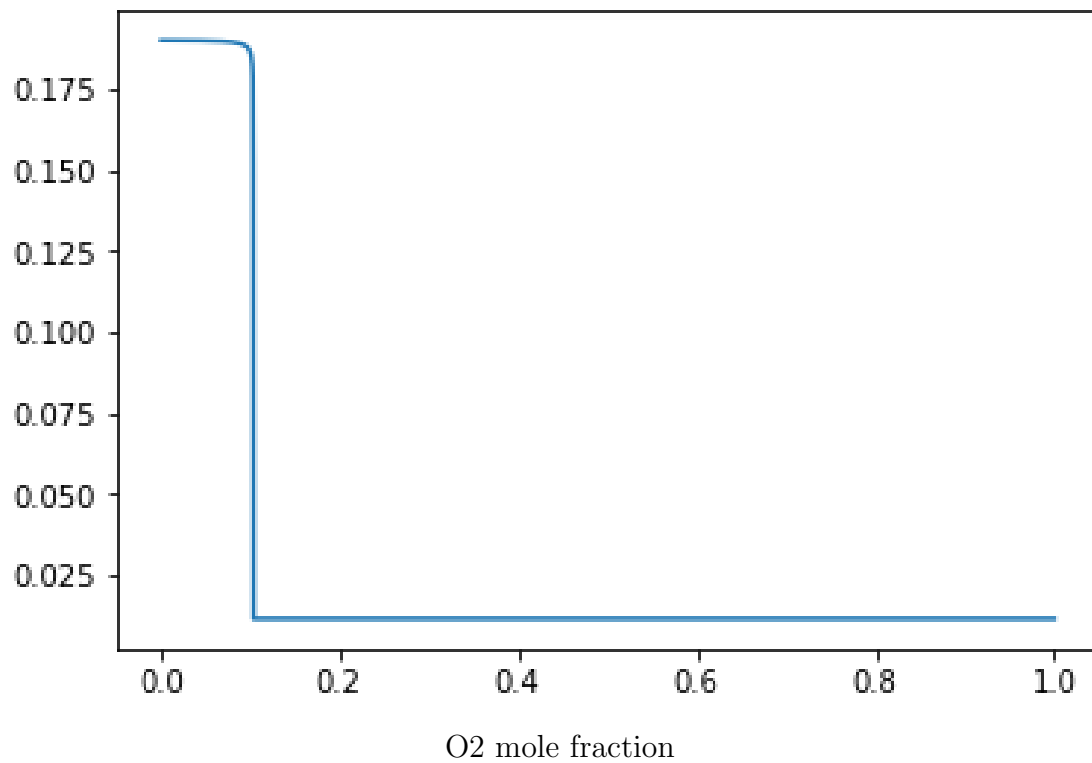


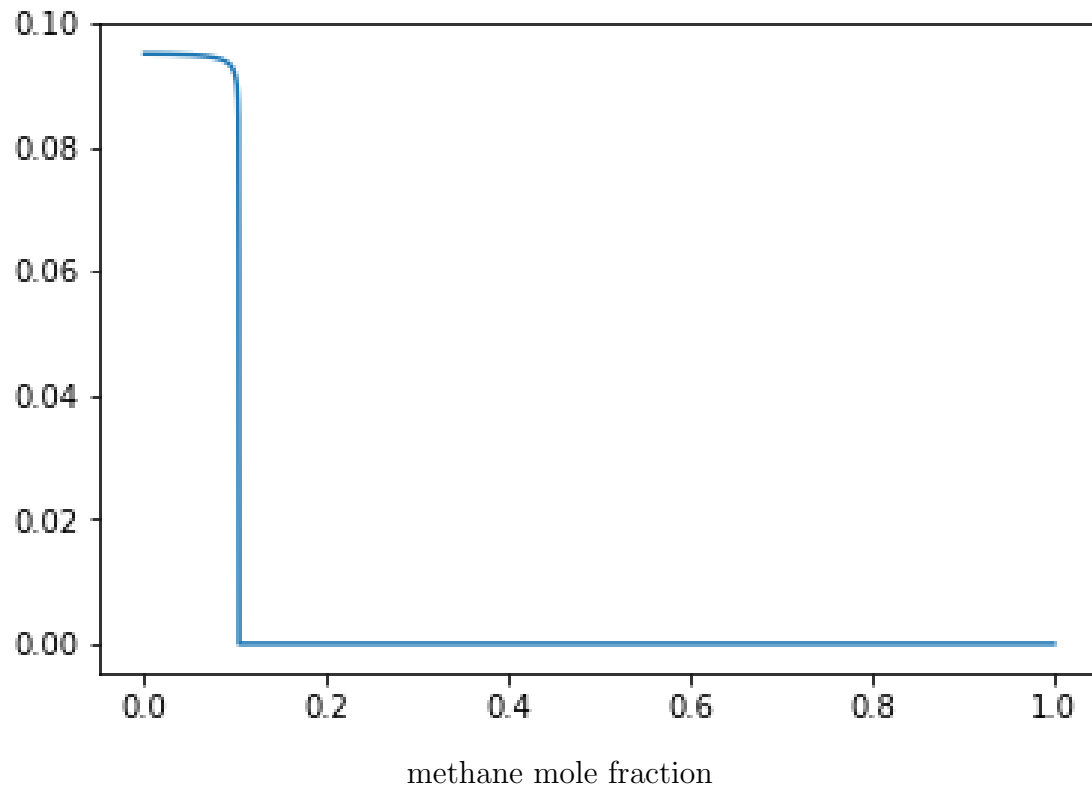






**2.3  $P=800000\text{Pa}$** 





### 3 Variable temperature

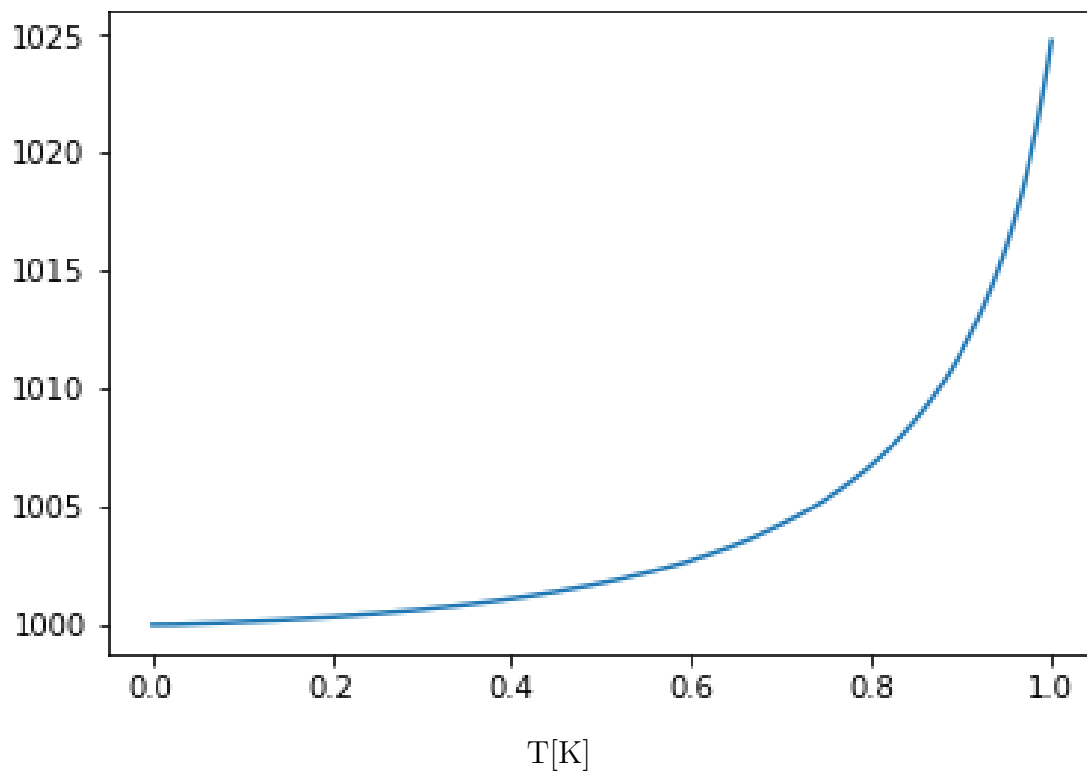
Pressure and equivalence ratio are constant.

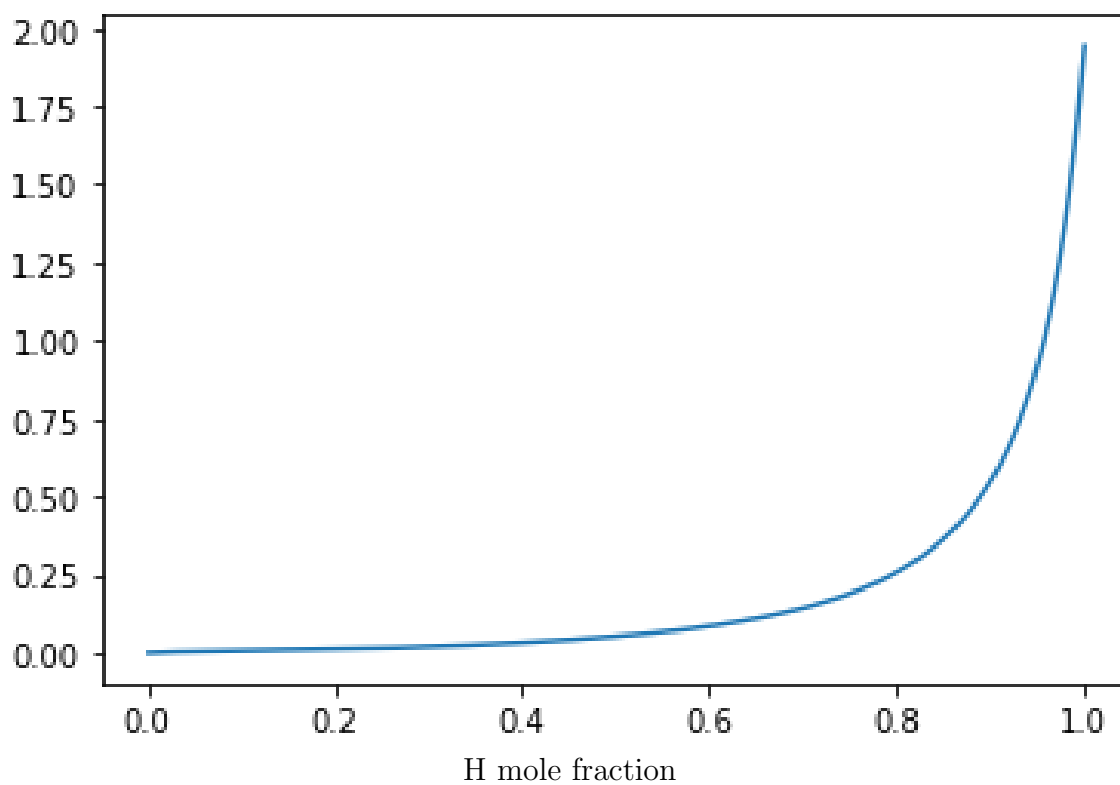
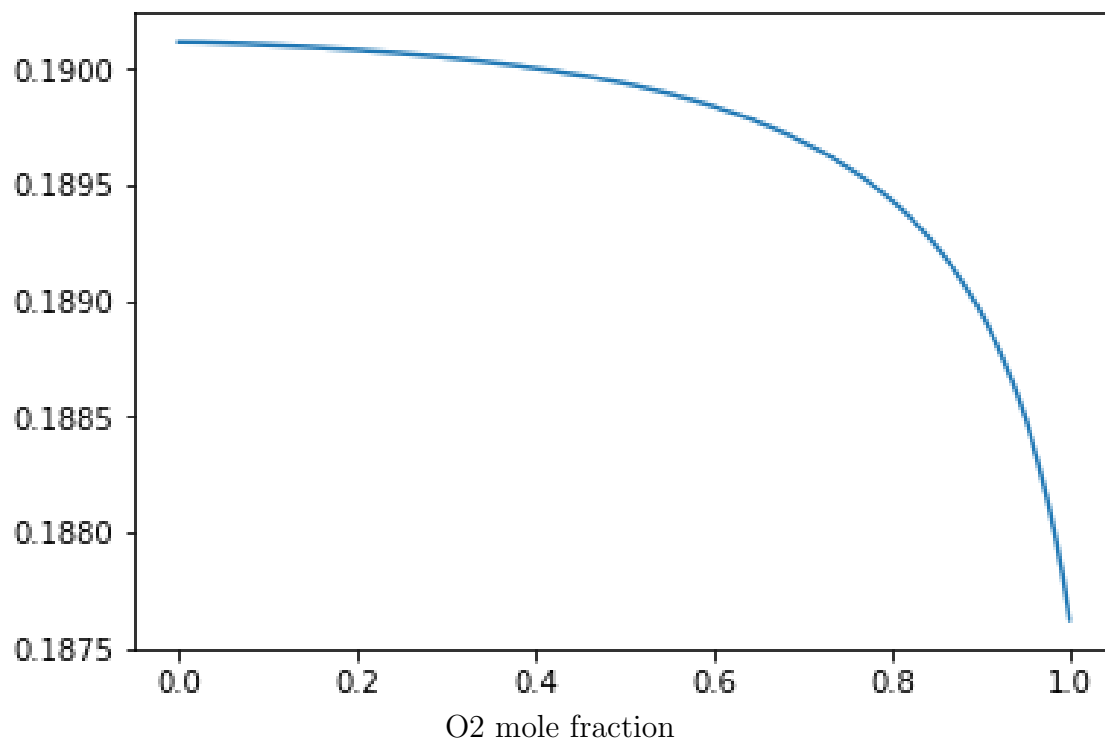
$P = 1013 \text{ hPa} = 1 \text{ atm.}$

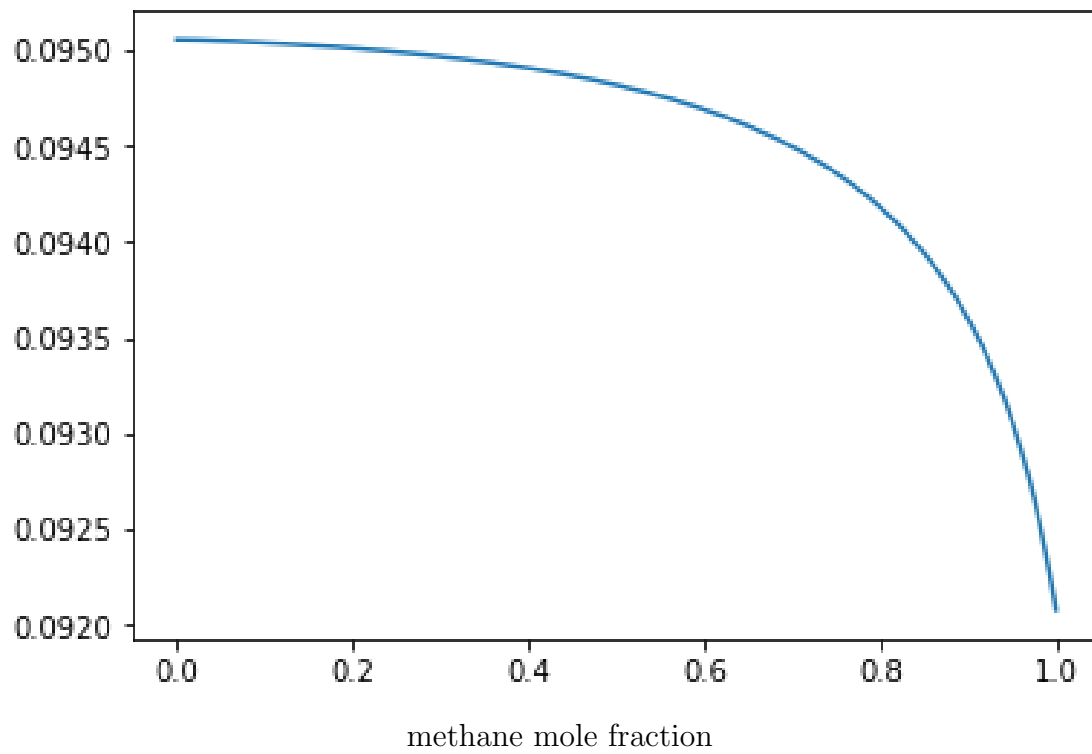
$\phi = 1$

Temperature in this section was variable and equal to three different values.

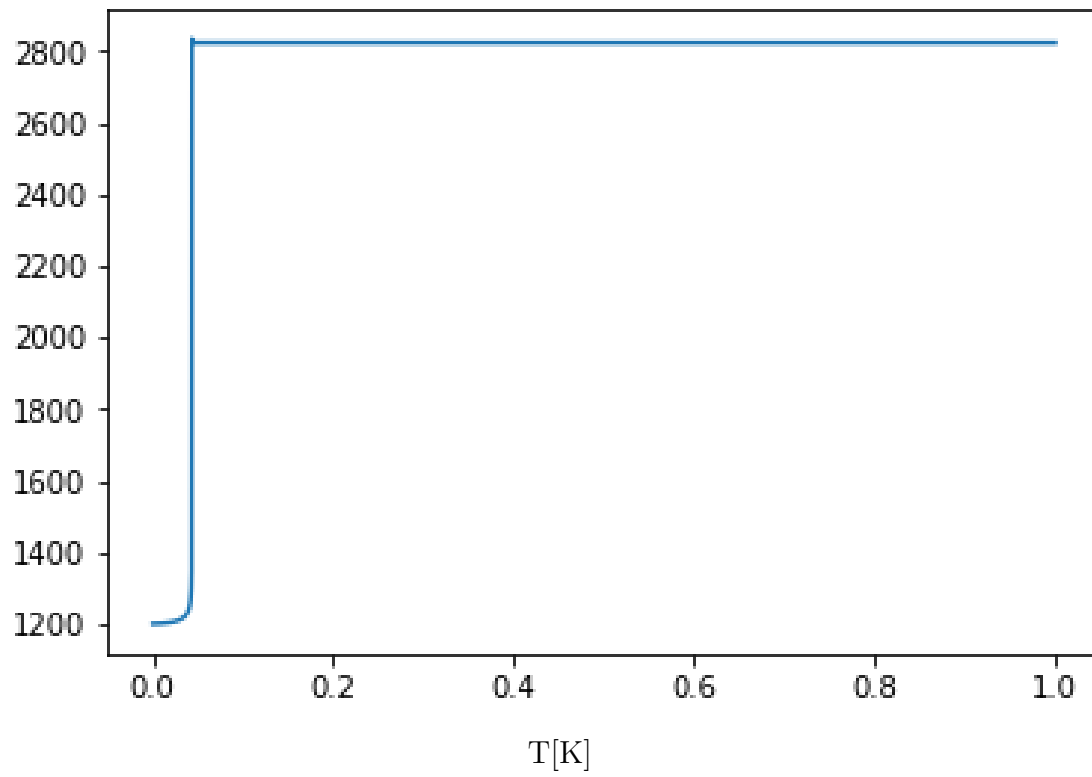
#### 3.1 $T = 1000 \text{ K}$



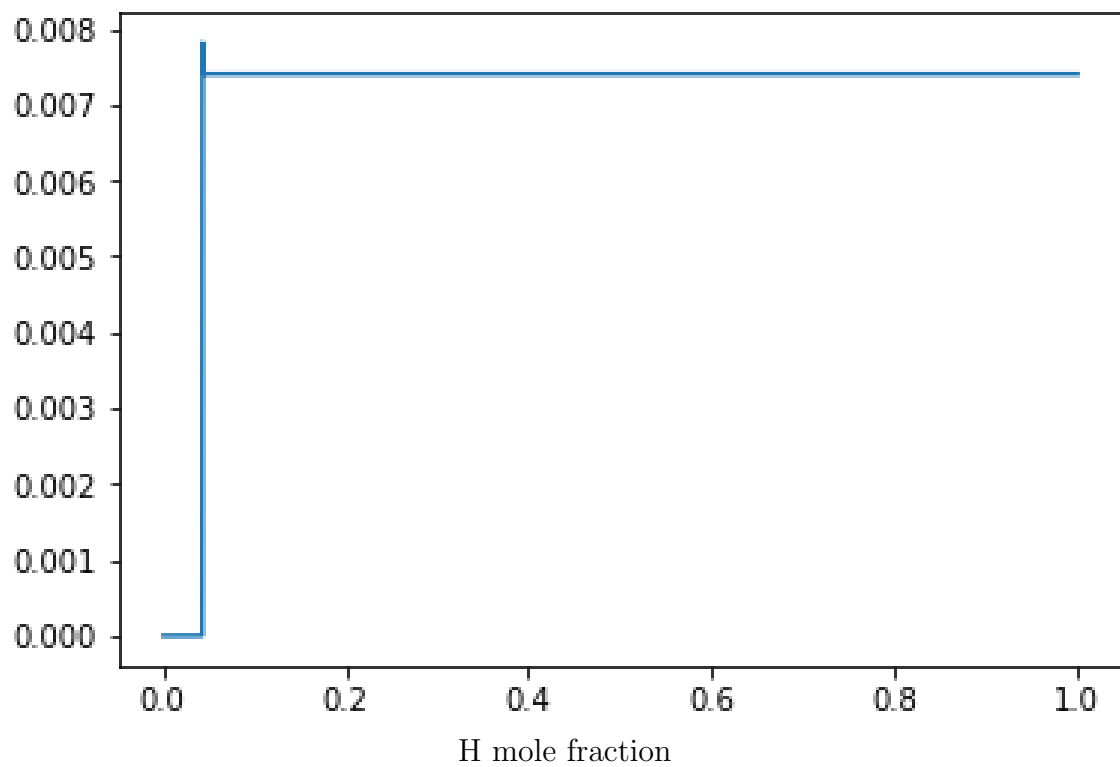
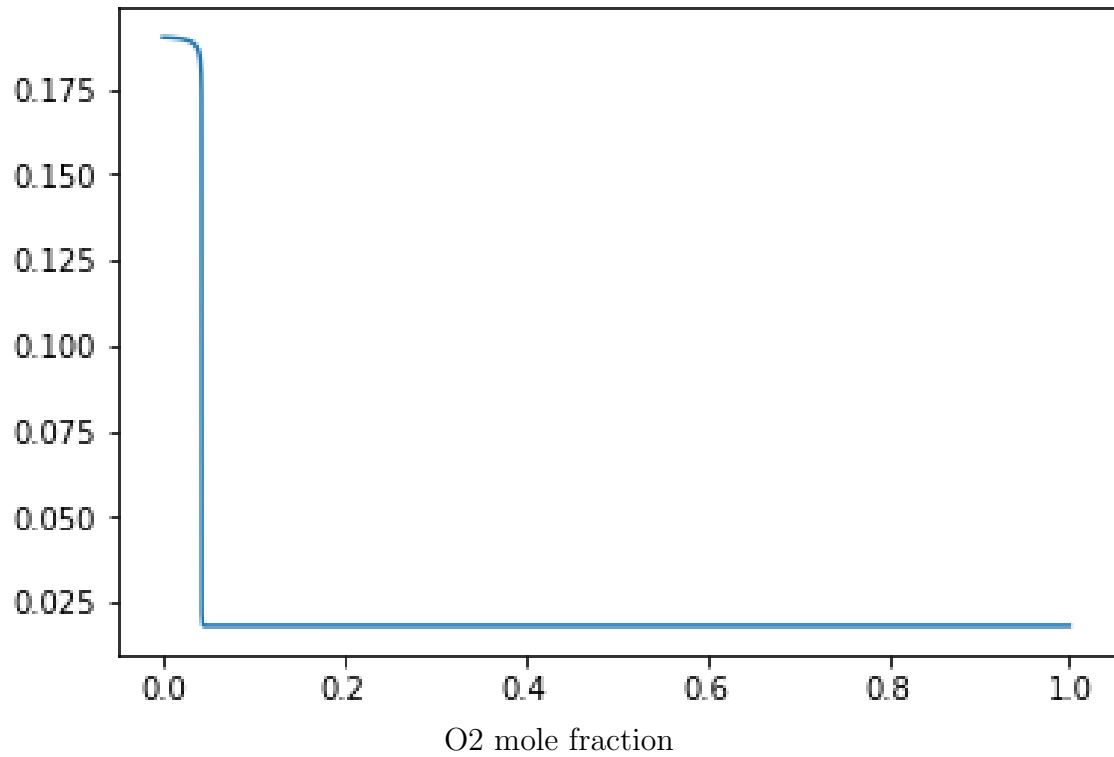


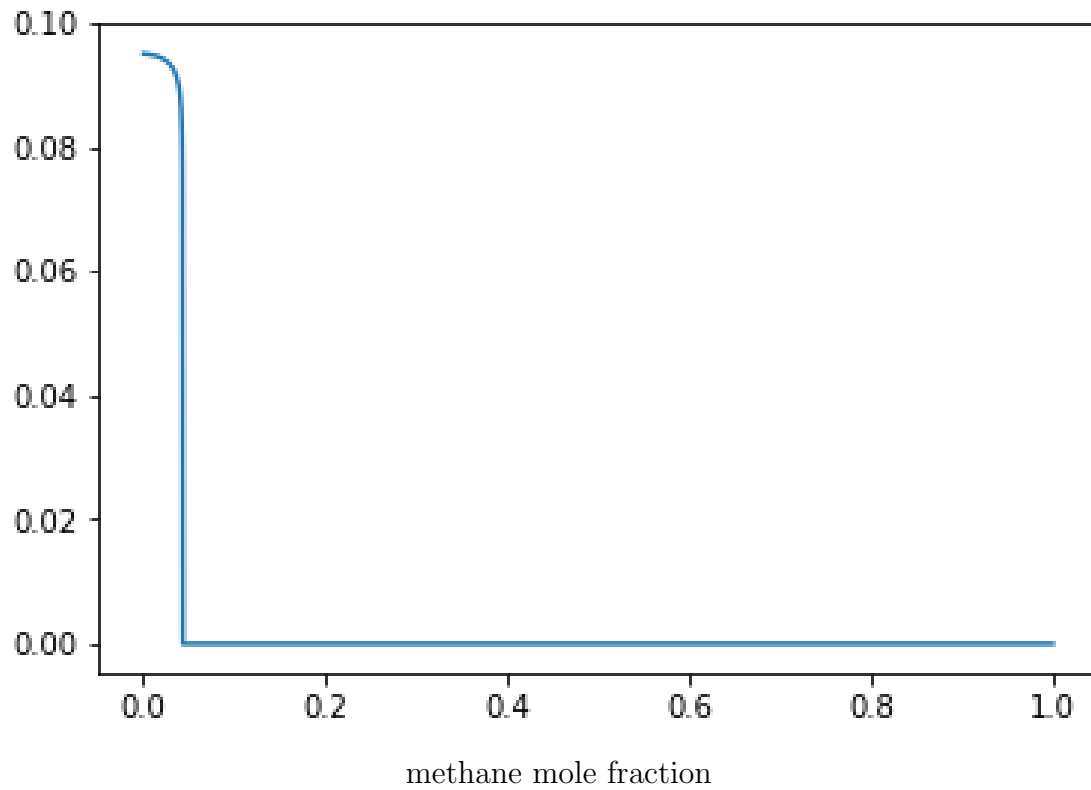


### 3.2 $T = 1200$ K

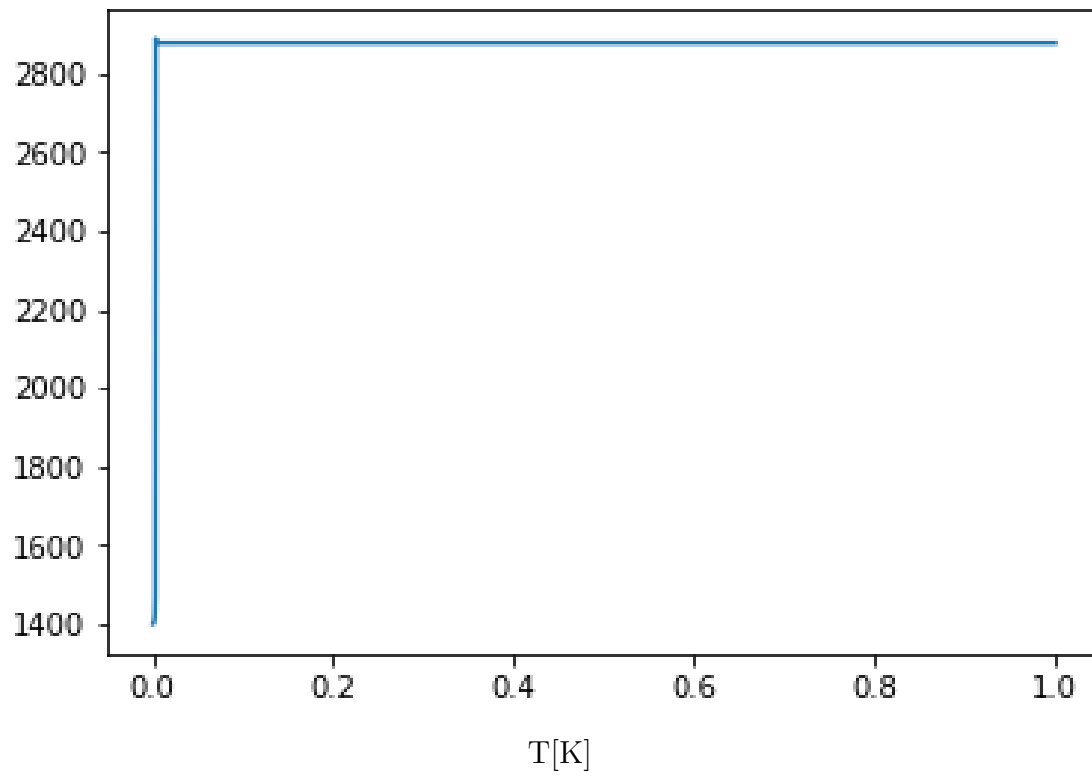


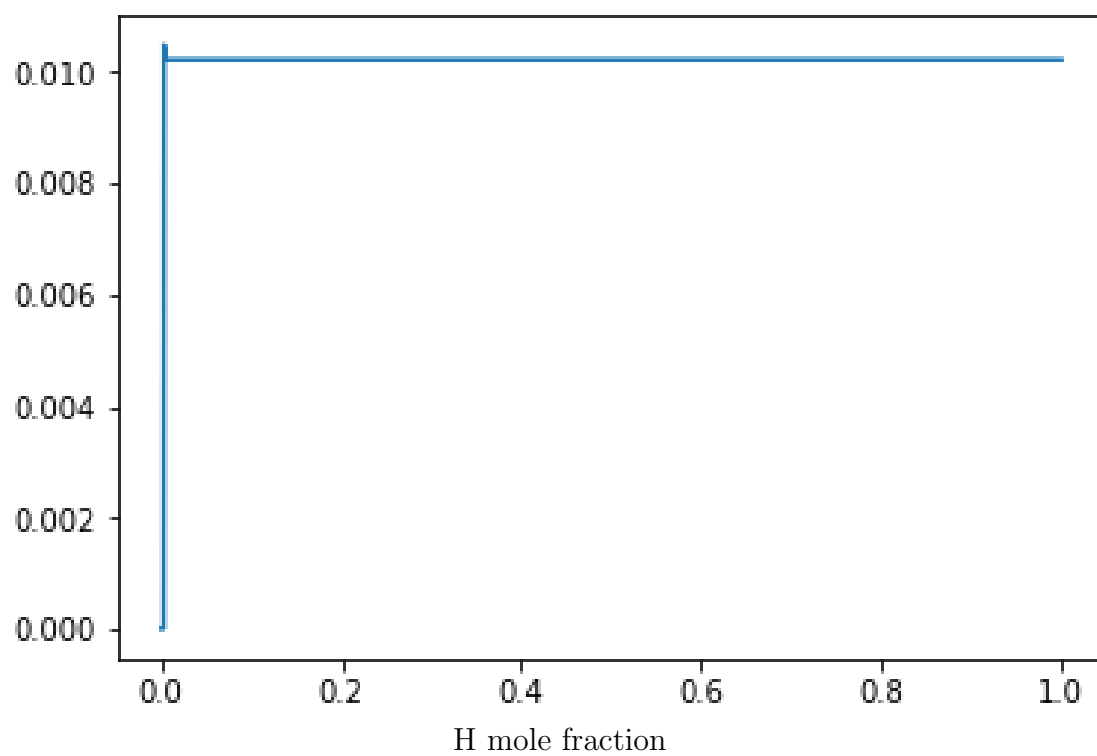
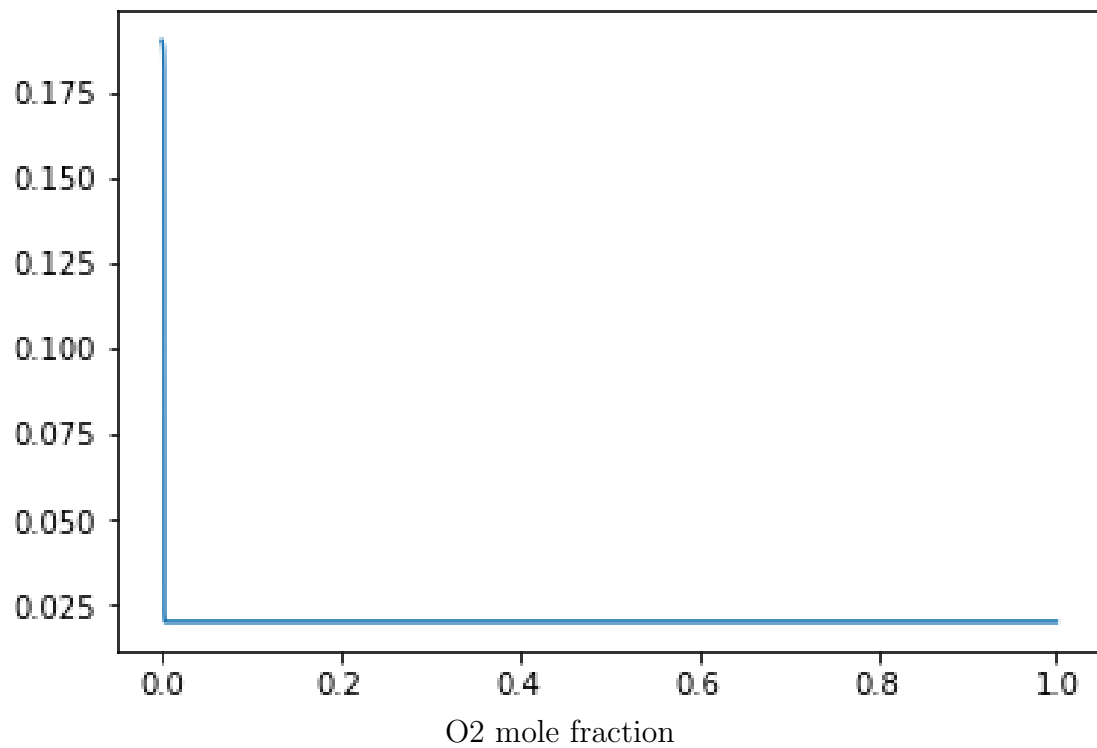


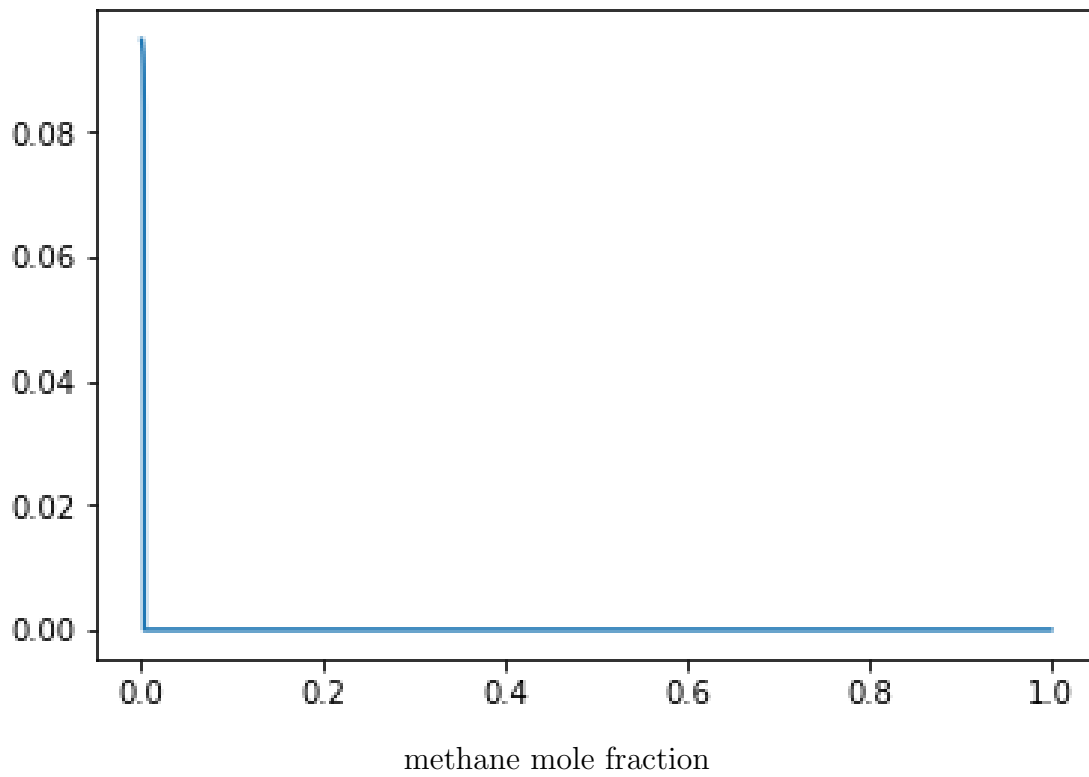




### 3.3 $T = 1400$ K







## 4 Variable equivalence ratio

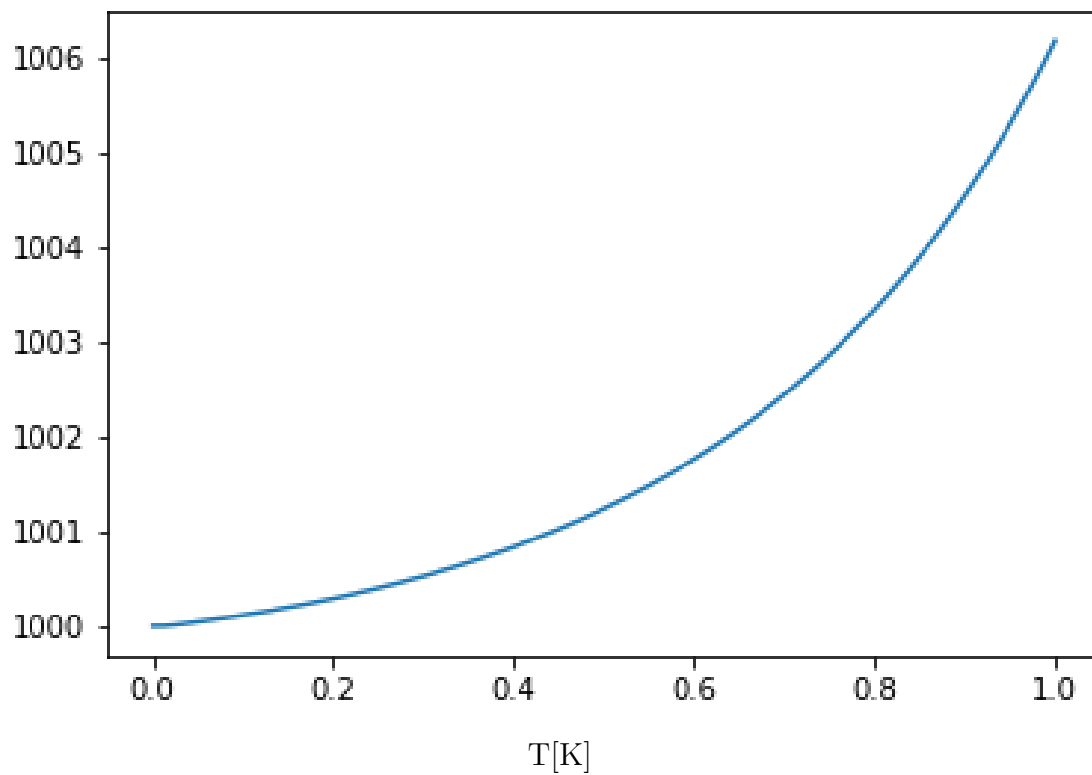
Pressure and temperature are constant.

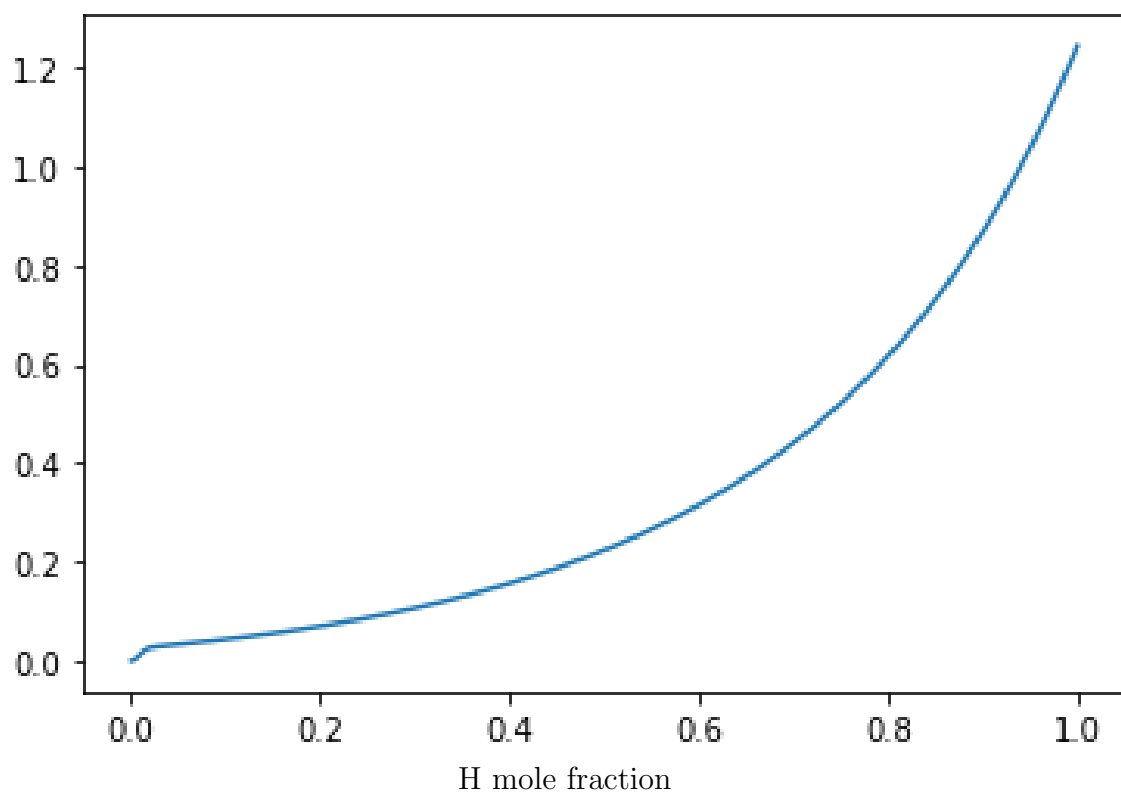
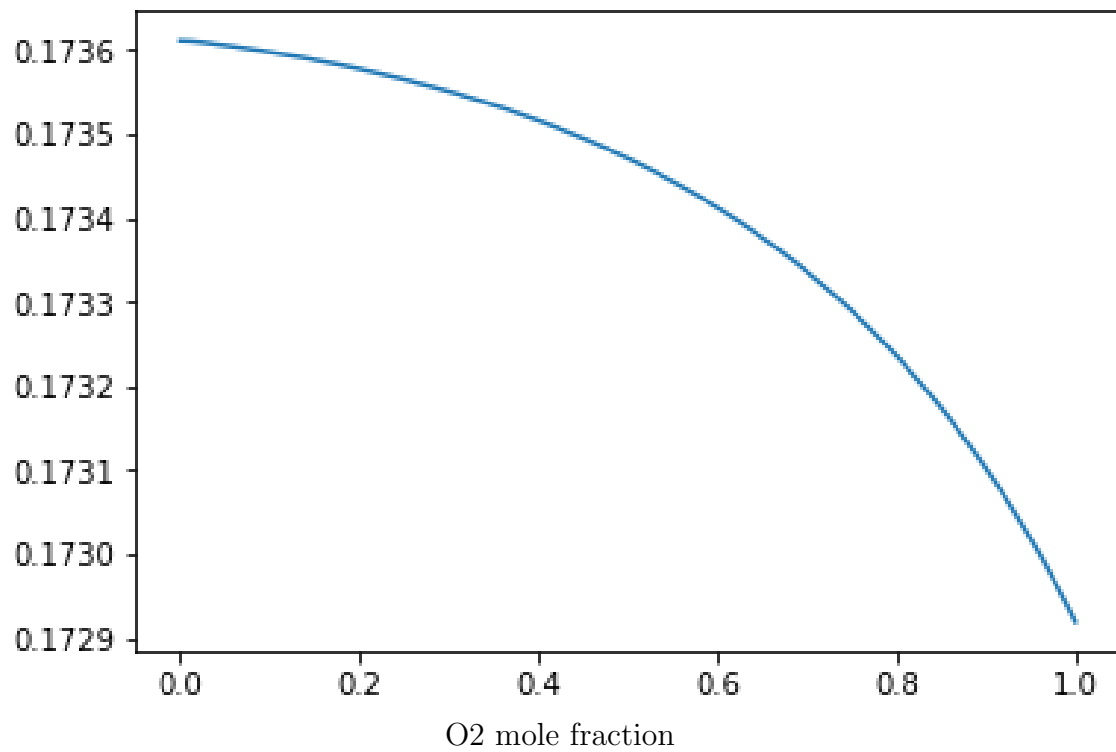
$P = 1013 \text{ hPa} = 1 \text{ atm.}$

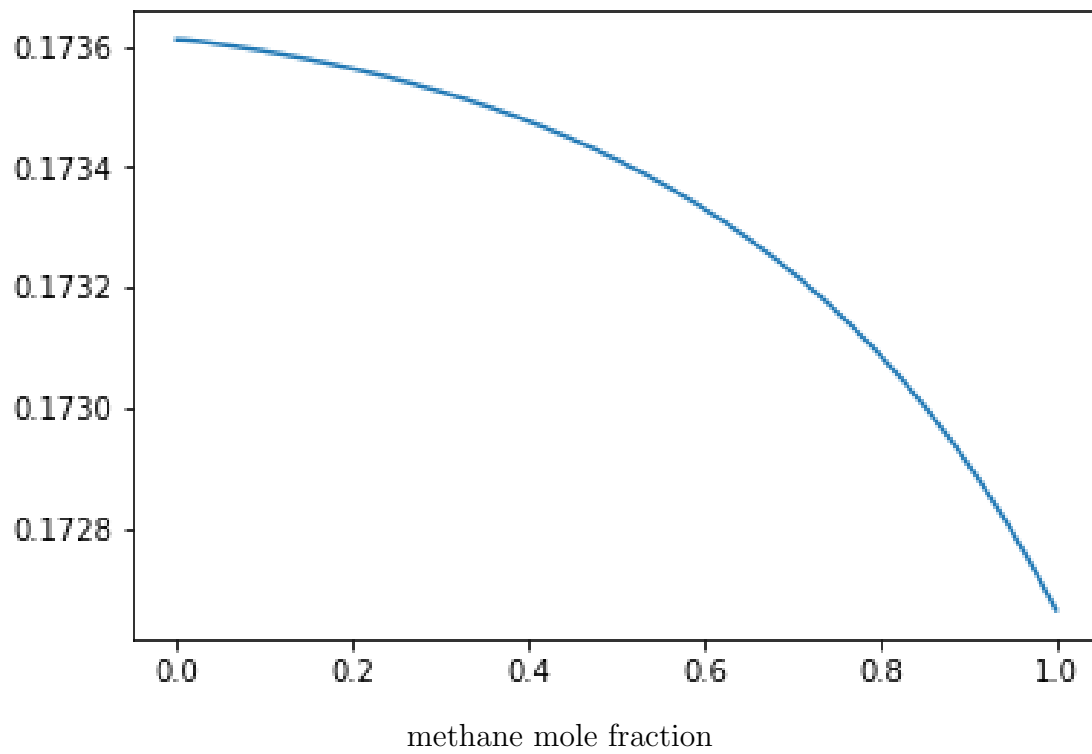
$T = 1000 \text{ K}$

Equivalence ratio in this section was variable and equal to three different values.

### 4.1 $\phi = 0.5$

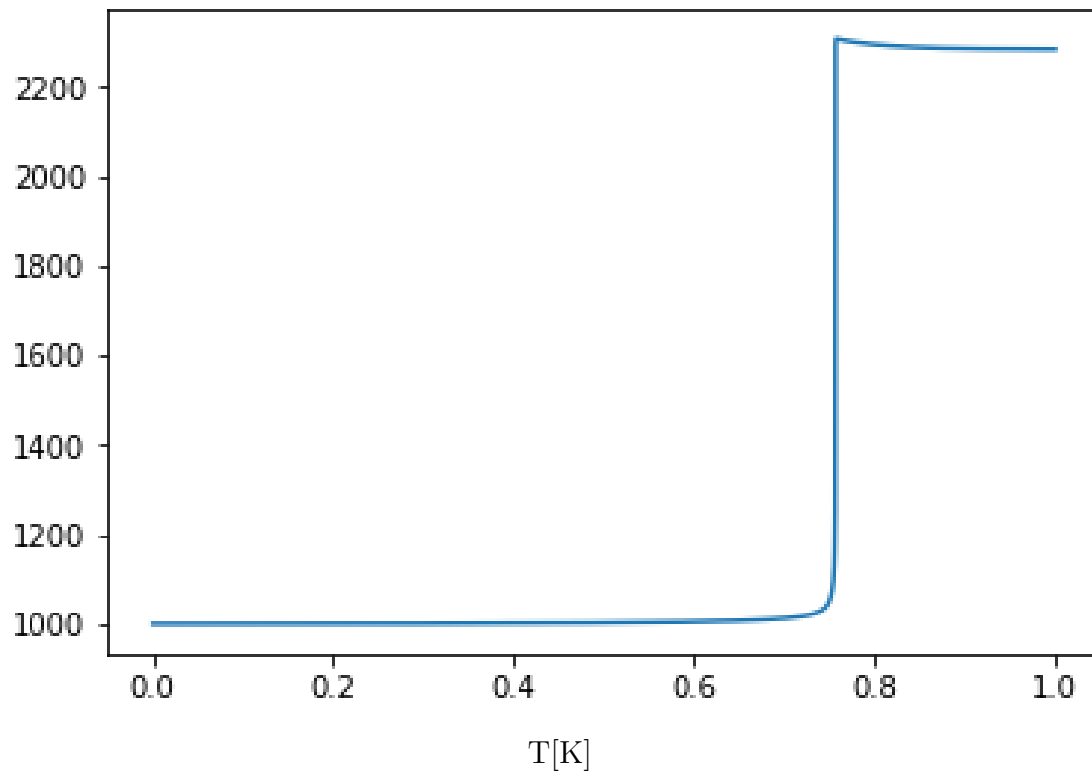


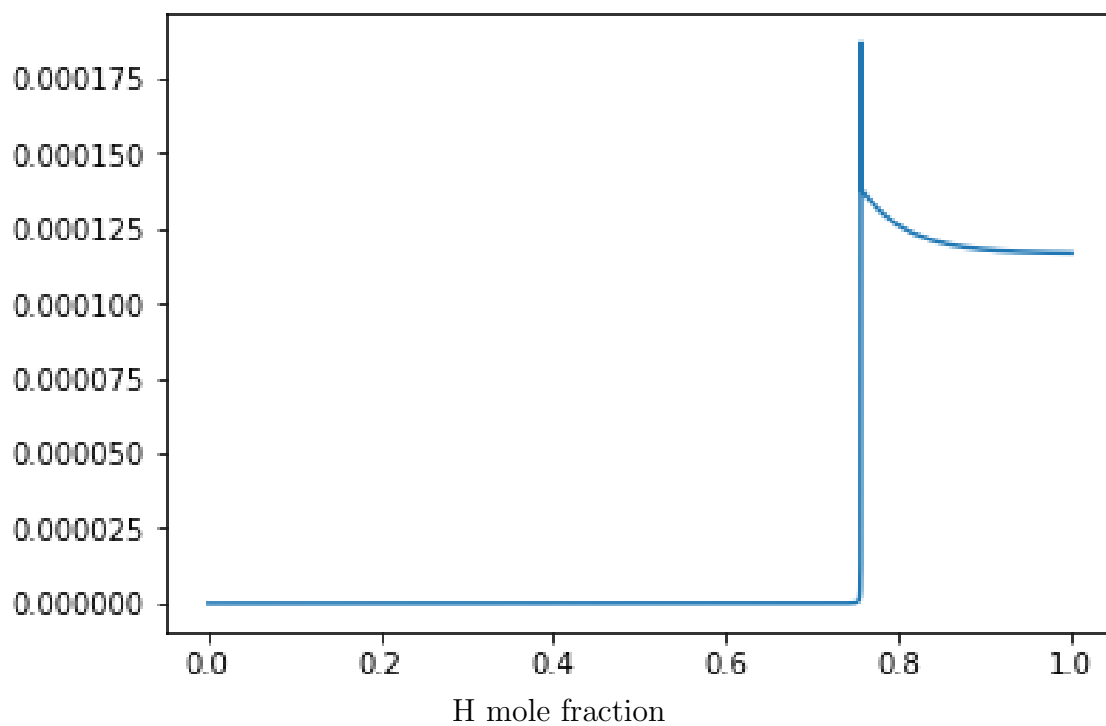
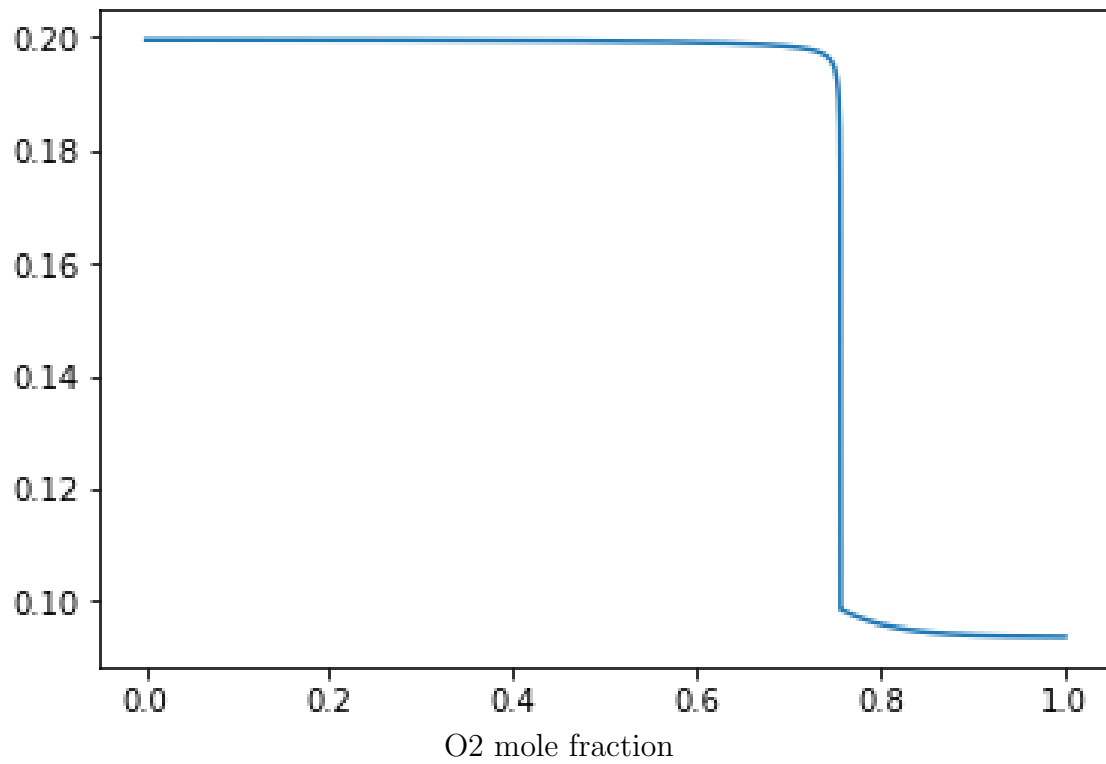


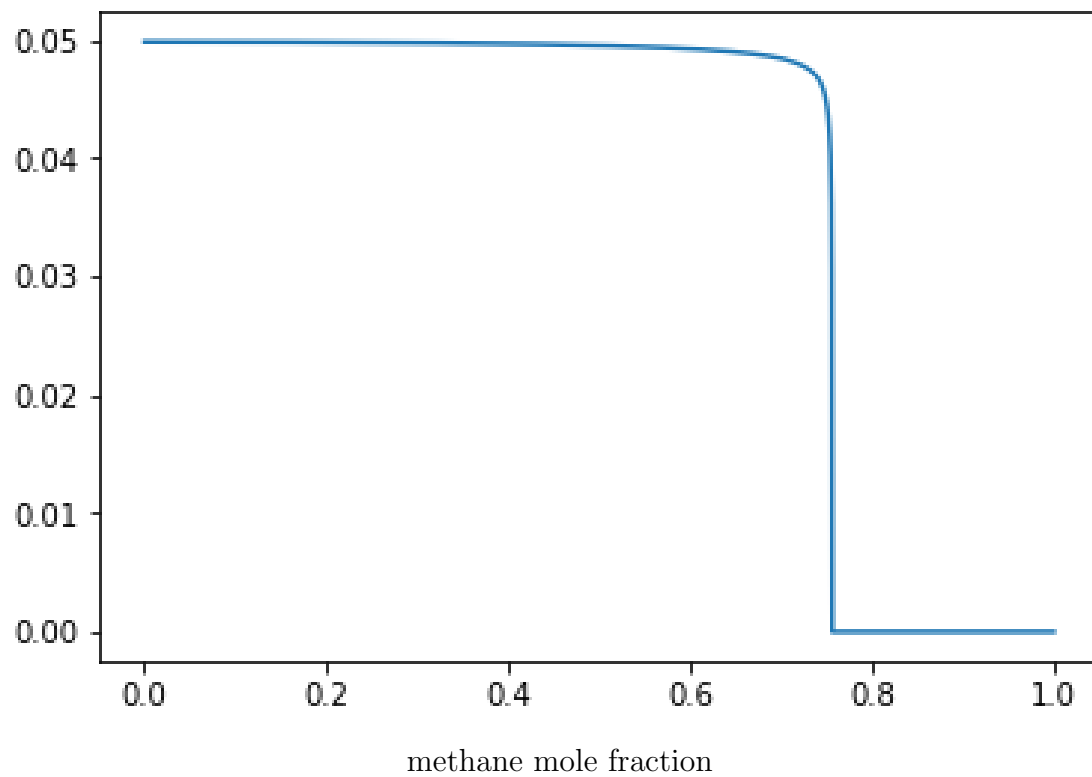




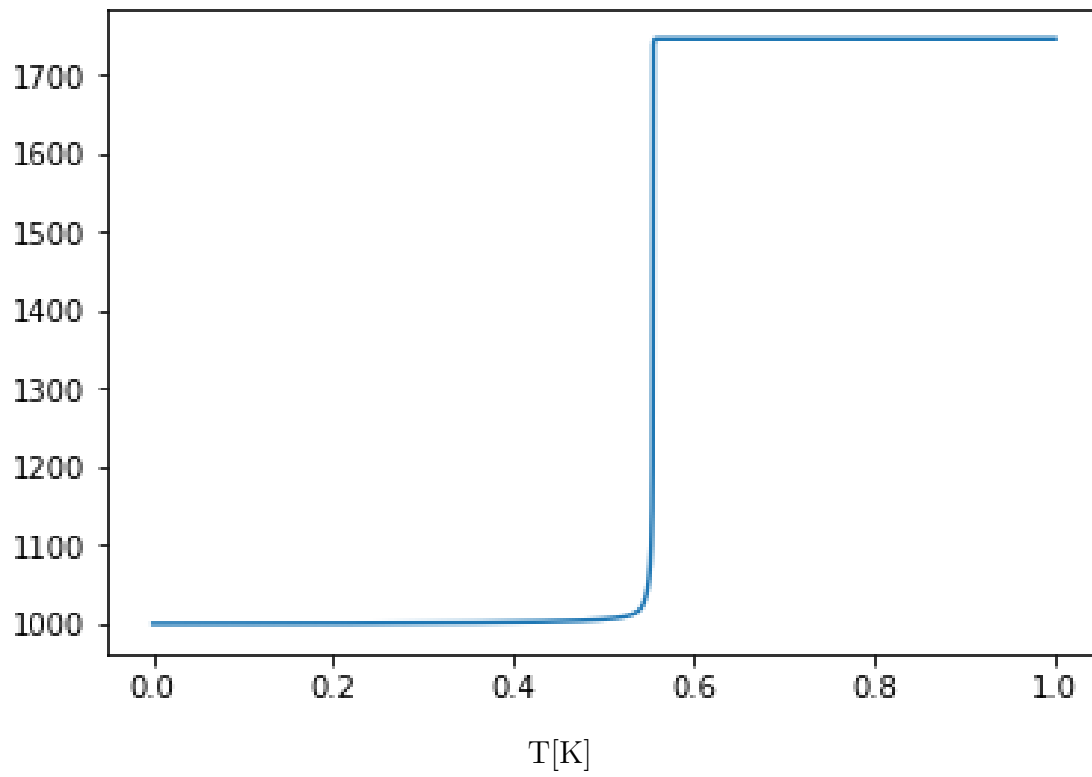
## 4.2 $\phi = 2$

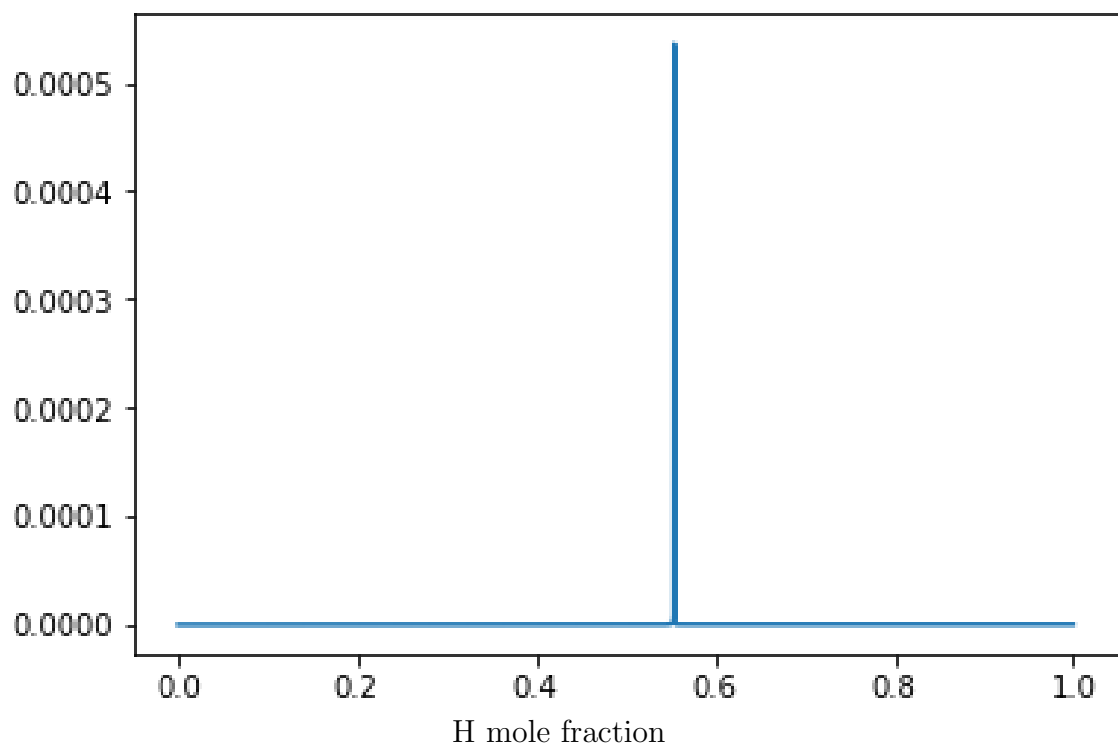
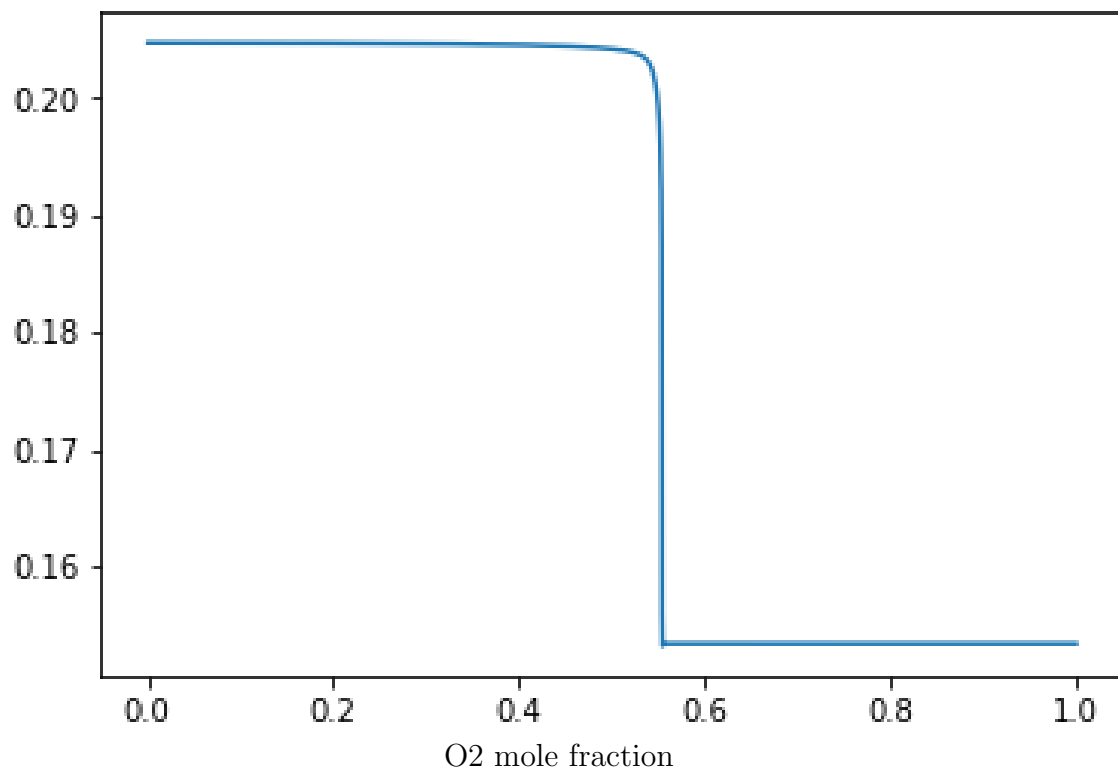


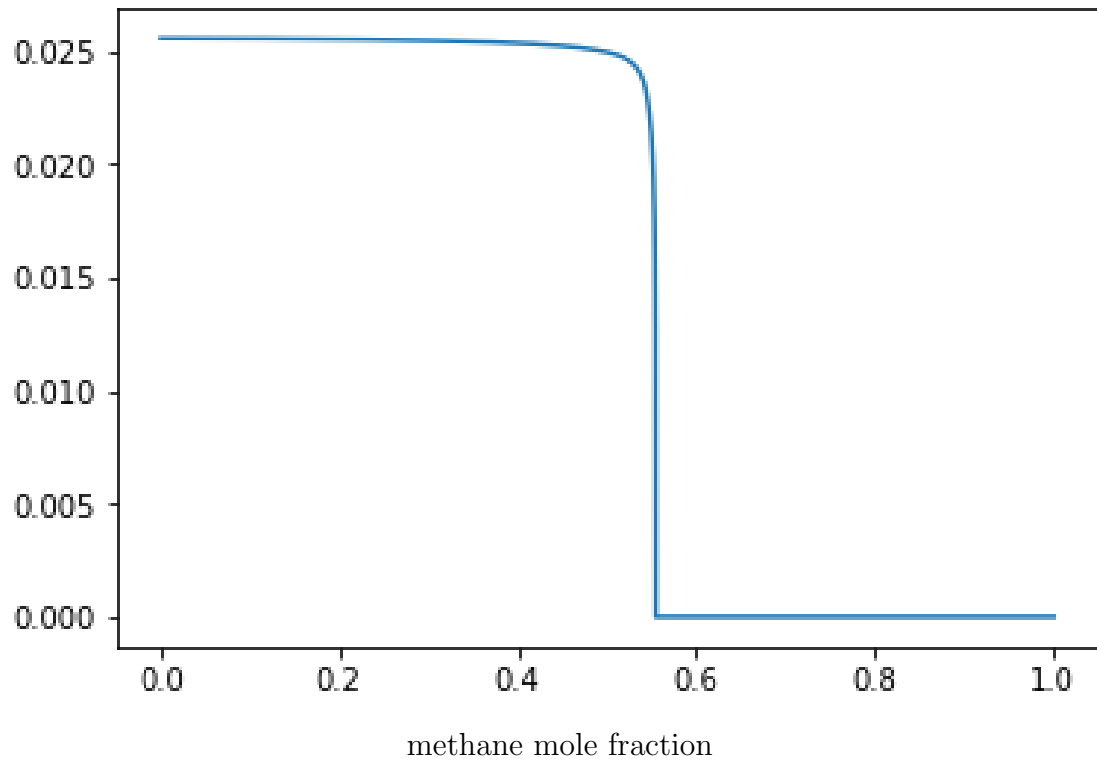




### 4.3 $\phi = 4$







## 5 Summary

### Conclusions

- Changes on initial parameters does not influence on O<sub>2</sub> mole fraction characteristic
- For low value of equivalence ratio the temperature does not rise what means the mixture is not burning

# Bibliography

- [1] [https://www.overleaf.com/learn/latex/Text<sub>a</sub>lignment](https://www.overleaf.com/learn/latex/Text_alignment)
- [2] [https://en.wikipedia.org/wiki/Flammability<sub>l</sub>imit](https://en.wikipedia.org/wiki/Flammability_limit)
- [3] Spalanie. Wybrane zagadnienia w zadaniach. M.Gieras
- [4] <https://www.youtube.com/watch?v=N4mEzFDjqtAt=757s> (Python programing tutorial)