Methane combustion in air and in oxygen- comparison

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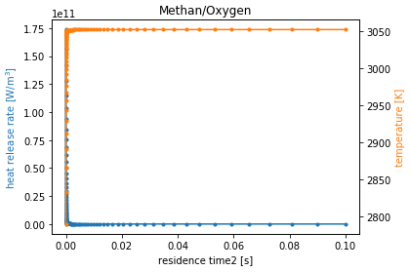
1 Introduction

This project raises the issue of combustion methane in air and in oxygen. Main task of this project is to show differences of combustion in air and in oxygen. There will be combustion in few different initial conditions. Different temperature, different pressure and different equivalence ratio. After deep researches, it is claimed that this project might be the only one raising this issue. In the text below, all examinations and calculations for different initial conditions are reported in graphs

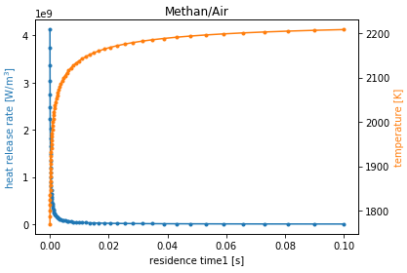
2 Calculations and Graphs

2.1 Equivalence ratio = 1

2.1.1 Temperature = 300K; pressure = 101325 Pa

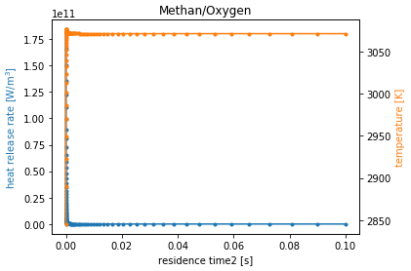


Oxygen

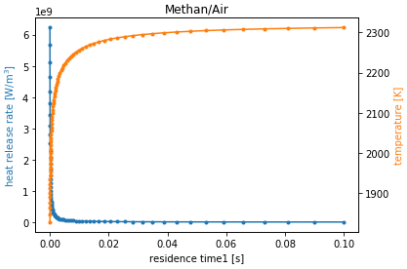


Air

2.1.2 Temperature = 500K; pressure = 101325 Pa



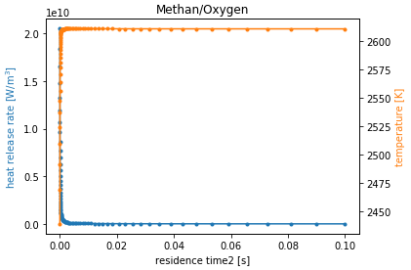
Oxygen



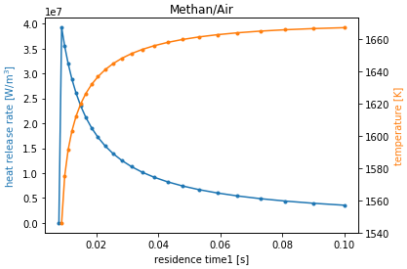
Air

2.2 Equivalence ratio = 2

2.2.1 Temperature = 300K; pressure = 101325 Pa



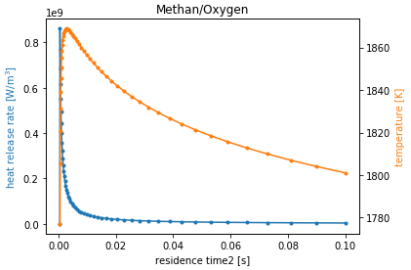
Oxygen



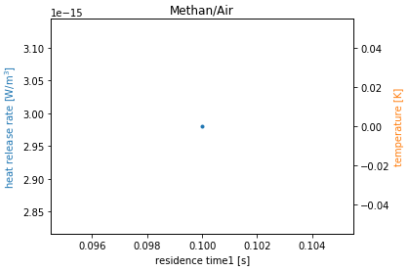
Air

2.3 Equivalence ratio = 3

2.3.1 Temperature = 300K; pressure = 101325 Pa

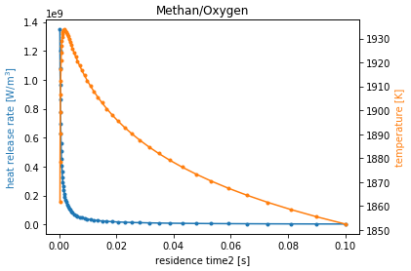


Oxygen

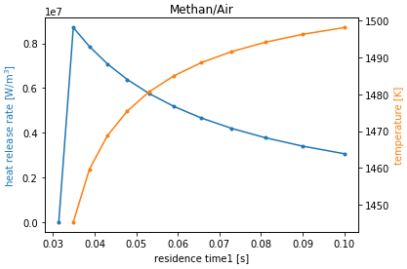


Air

2.3.2 Temperature = 500K; pressure = 101325 Pa

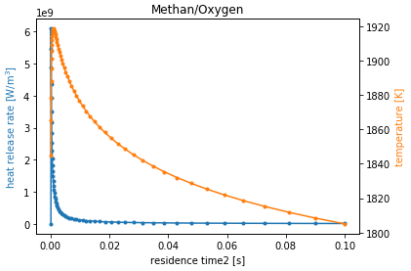


Oxygen

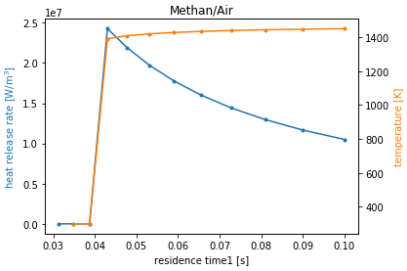


Air

2.3.3 Temperature = 300K; pressure = 300000 Pa



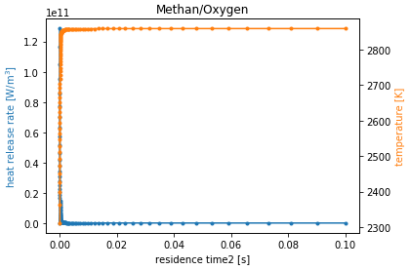
Oxygen



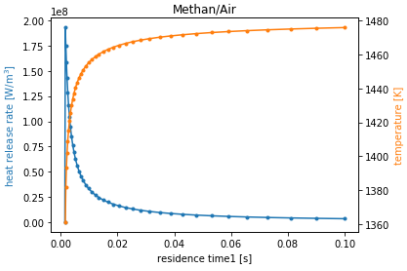
Air

2.4 Equivalence ratio = 0.5

2.4.1 Temperature = 300K; pressure = 101325 Pa

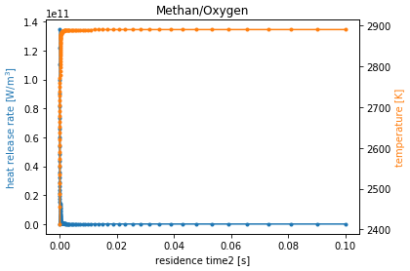


Oxygen

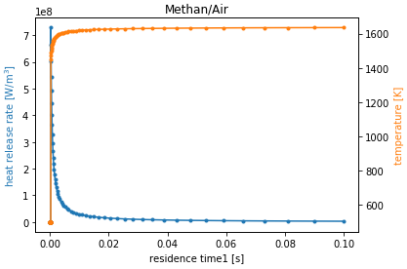


Air

2.4.2 Temperature = 500K; pressure = 101325 Pa



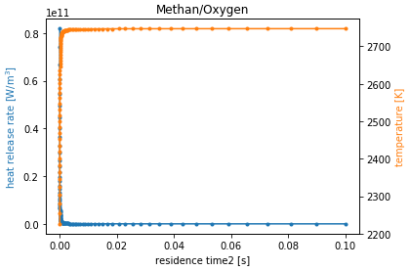
Oxygen



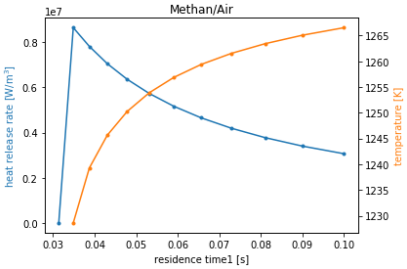
Air

2.5 Equivalence ratio = 0.4

2.5.1 Temperature = 300K; pressure = 101325 Pa



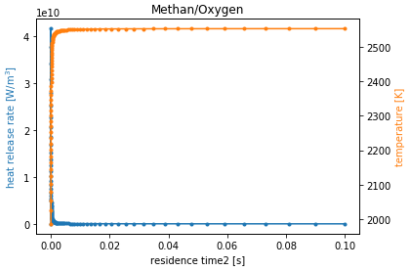
Oxygen



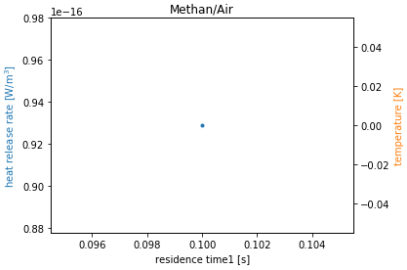
Air

2.6 Equivalence ratio = 0.3

2.6.1 Temperature = 300K; pressure = 101325 Pa

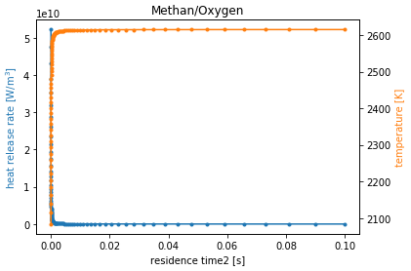


Oxygen

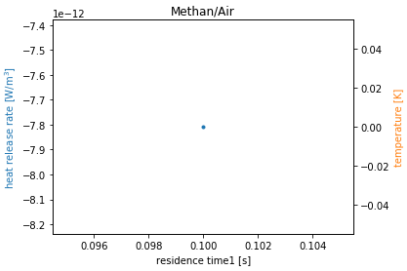


Air

2.6.2 Temperature = 500K; pressure = 101325 Pa



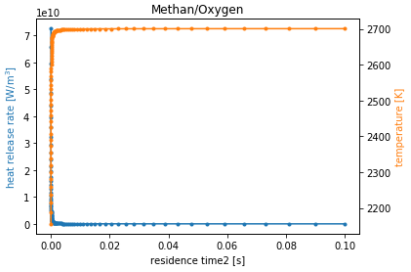
Oxygen



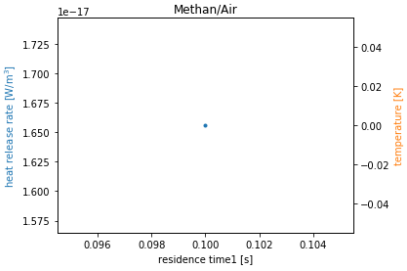
Air

2.7 Equivalence ratio = 0.37

2.7.1 Temperature = 300K; pressure = 101325 Pa

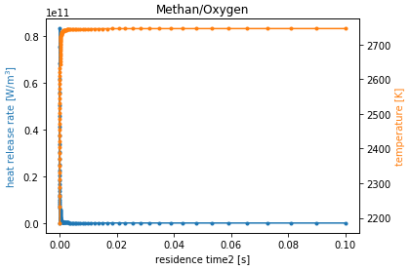


Oxygen

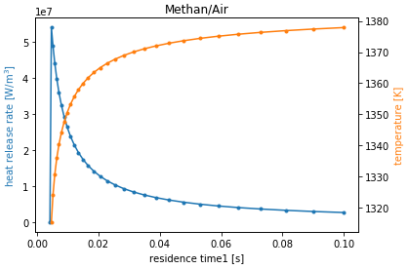


Air

2.7.2 Temperature = 500K; pressure = 101325 Pa

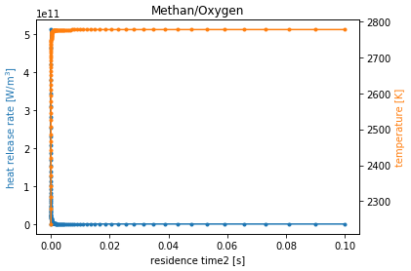


Oxygen

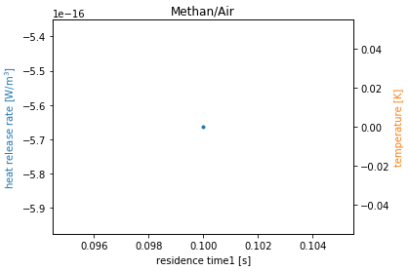


Air

2.7.3 Temperature = 300K; pressure = 300000 Pa



Oxygen



Air

3 Conclusion

After deep analysis of these calculations and graphs there are several conclusions.

First of all, there is lower limit and upper limit of equivalence ratio for methane combustion in oxygen and air, but equivalence ratio of methane and oxygen has bigger scale than methane and air. Sometimes when methane combustion in air is impossible, (for example combustion nr. 2.3.1) methane combustion in oxygen is still possible. However, it was noted that after increasing temperature or pressure, methane combustion in air is possible again.

So second conclusion is that probability of successful combustion of methane in air or in oxygen is getting bigger after raising temperature or pressure.

Third conclusion is that increasing pressure or temperature also increases heat release rate and temperature of combustion.