An angle of flame cone - Bunsen Burner

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May 23, 2017

1 Introduction

The purpose of this simulation is to show how cone angle is changing reference to pressure and temperature of burning mixture. Assumptions: flame speed is constans (we can change it manually in program), calculations are made for 1 mole per second expense, nozzle of burner is 1 cm diameter.
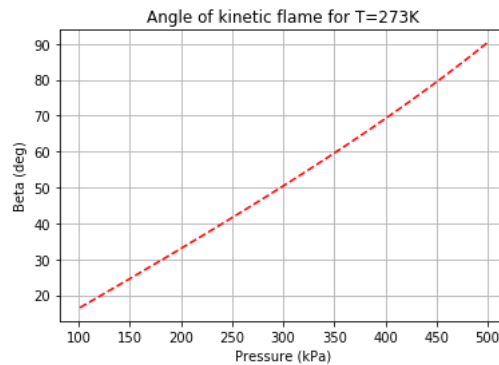
2 Mathematic model

When burning speed is known we get simple analitycal formula which depends on nozzle diameter d_l, flame speed s_l, pressure p, mole expense n and temperature T:
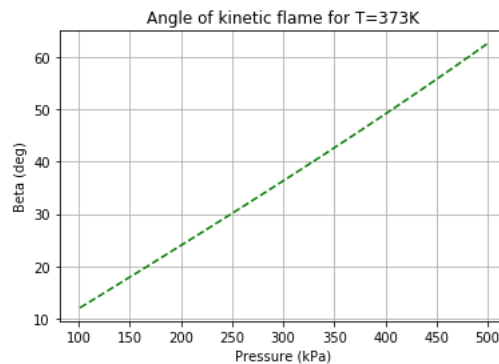
$$\beta = arcsin(\frac{s_l * p * \pi * (\frac{d_l}{2})^2}{n * R * T})$$
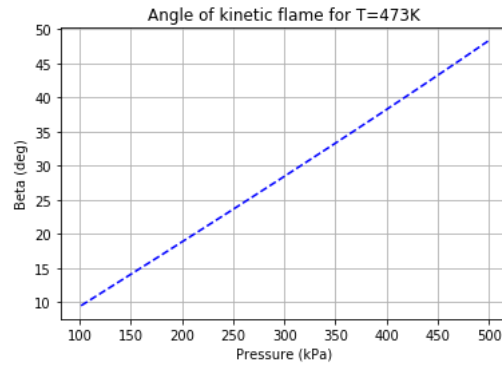
3 Results and conclusions

Calculations were made for temperatures from 273 to 773 K, for pressure from 1 to 5 bars and for methane-air mixture flame speed 4.1 cm/s.
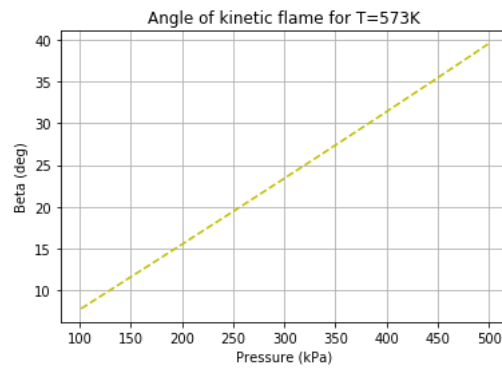

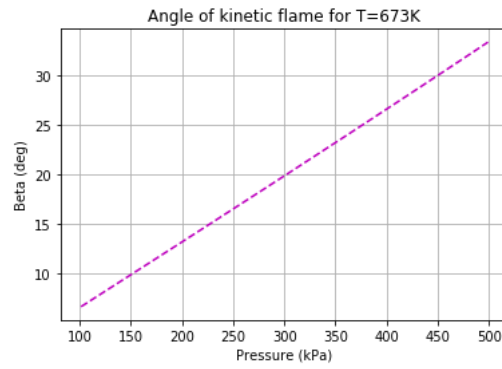Calculations for T=273K temperature.

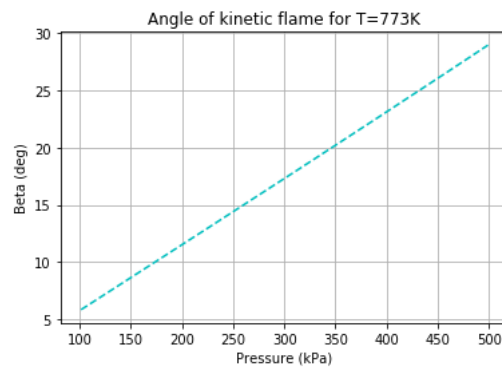Calculations for T=373K temperature.

Calculations for T=473K temperature.

Calculations for T=573K temperature.

Calculations for T=673K temperature.

Calculations for T=773K temperature.

As you can see characteristics are nearly linear and the temperature is higher the angle is lower for the same pressure. It can have coincidence with hardly simplified model of calculations.

4   Bibliography

Webpages and books used to make project and report:

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https://matplotlib.org/users/pyplot_tutorial.html

https://matplotlib.org/examples/pylab_examples/simple_plot.html

http://www.cantera.org/docs/sphinx/html/cython/tutorial.html

http://www.cantera.org/docs/sphinx/html/cython/constants.html

http://www.cantera.org/docs/sphinx/html/cython/thermo.html

http://www.cantera.org/docs/sphinx/html/cython/examples/onedim_flamespeed_sensitivity.html

http://www.cantera.org/docs/sphinx/html/cython/onedim.html

Marian Gieras "Spalanie. Wybrane zagadnienia w zadaniach"