

Potentialities of plasma multi jets devices at atmospheric pressure for the performance improvement of combustion.

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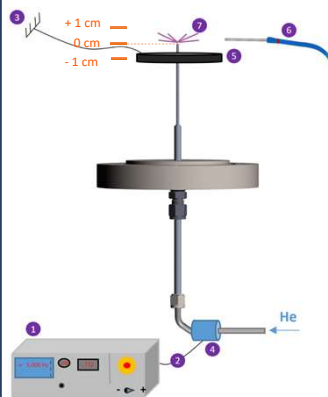
Abstract

The establishment of a mixed plasma-combustion system has drawn significant attention. It would compensate the stability deficiencies of the flame, therefore controlling pollutants emissions for improving energy performance of combustion systems [1]. To obtain a better homogeneous distribution of species, a patented helium plasma multi-jets setup has been used powered by "GENEPULSE power supply". Spectra of the free radicals present were recorded under different operating conditions; by analyzing metallic targets effects on plasma jets (positions, dimensions of the ring). Investigation has been completed by electrical parametric study (voltage of the power supply).

This study focuses on plasma multi jets for the performance improvement of combustion.



Experimental Setup



1. Power supply 'GENEPULSE'

1,2 μ s Voltage pulses
f = 16 kHz
U = 12 ~ 14,5 kV

2. High voltage

3. Ground

4. Reactor

5. Ring (Dr1= 71mm, Dr2= 56mm, Dr3= 36mm)

6. Ring position from the top of the injector (+1 cm, -1 cm)

7. Optical fiber (position : 50 mm from the injector)

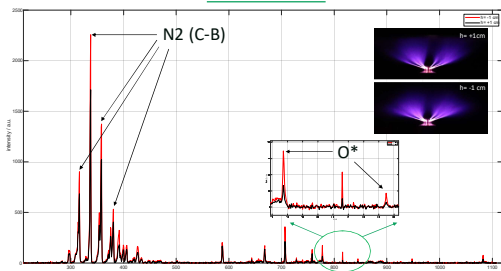


8. Multi jets plasma

9. He flow = 1 L/min

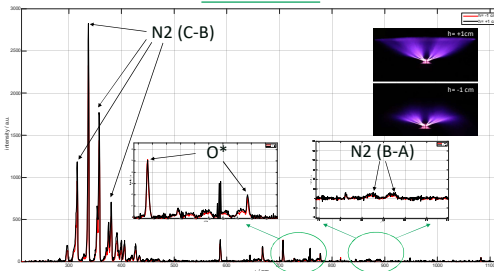
Position of the Ring effect

Dr 1 = 71 mm



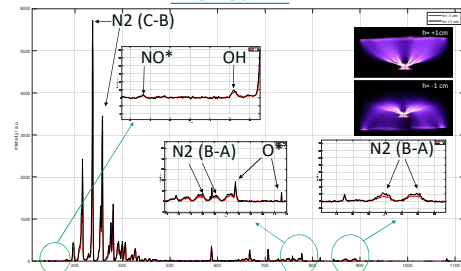
Ring at h = +1 cm from the injector

Dr 2 = 56 mm

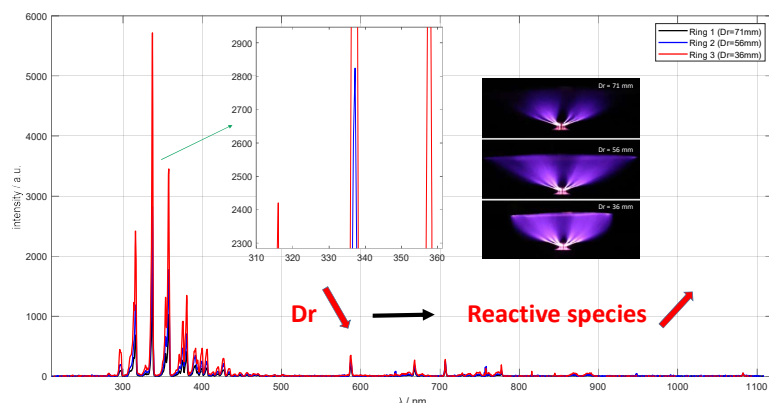


Reactive species

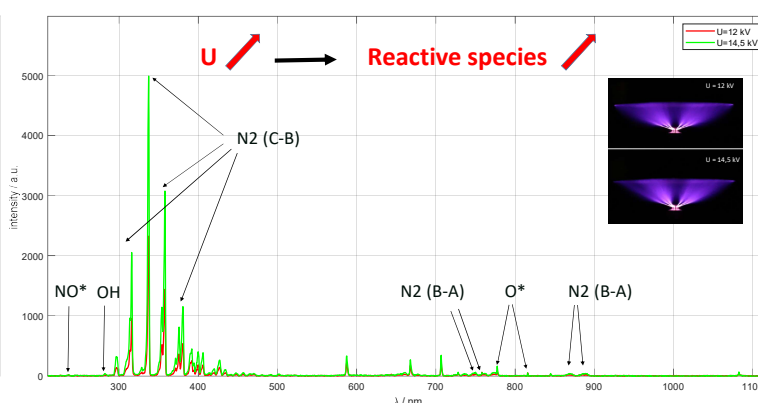
Dr 3 = 36 mm



Dimension of the Ring effect (at +1cm from the injector)



Voltage effect



Conclusions

- Reactive species are produced in higher quantity as the diameter of the ring decreases, and as the voltage rises, also when the ring is positioned at h=+1 cm from the injector.
- To combine a plasma multi jets with a laminar lean premixed flame.
- The diagnostics are still very challenging for multi jets owing to the large uncertainty, Spectra of the free radicals should be more investigated for excited species OH, NO*...

Acknowledgement

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References

- [1] Yinguang Ju et al, *Plasma Chem Plasma Process*, 36:85–105 (2016)