Microwave Plasma at atmospheric pressure: Improving characteristic parameters of Syngas decomposition in an Argon Plasma

A. Cobos-Luque, F.J. Morales-Calero, J. Muñoz, A.M. Raya, R. Rincón(*), M.D. Calzada

Laboratorio de Innovación en Plasmas, Edificio Einstein (C2), Campus de Rabanales, Universidad de Córdoba, 14071, Córdoba, Spain

CH_4 and CO_2 (main components of biogas) are some of the most important pollutants emitted by the industries in almost every country, resulting in the concentration of those greenhouse gases in the terrestrial atmosphere above tolerable levels. Although industry keeps evolving to a more sustainable situation, these emissions should be completely avoided. In the last years, plasma technology has been proposed for their mitigation and even neutralization [1]. In this context, plasmas sustained at atmospheric pressure are in the spotlight since the technology can be implemented up to industrial scale.

Among different plasma sources, microwave plasmas have been proven to be capable of reaching either high CO_2 decomposition rates or competent energy efficiencies, but hardly obtained simultaneously [1]. Therefore, further studies are needed for the improvement of this technology. In this research, surfatron based microwave atmospheric pressure plasmas [2] sustained at 200 W are studied for the decomposition of a CO_2 flow of 10 mL/min in 3 L/min of argon. As Figure 1 shows, CO, C and CN molecular bands are observed in the emission spectrum of an Ar/CO_2 plasma, as well as atomic lines of C and O which certainly indicates that the decomposition process takes place. It is also interesting, for outcoming research, to analyze dry reforming processes (decomposition of $CO_2 + CH_4$) [3] which is also very promising given that biogas has high carbon content, and it has been proven that nanostructured carbon material can be synthesized with these plasmas while greenhouse gases are neutralized.

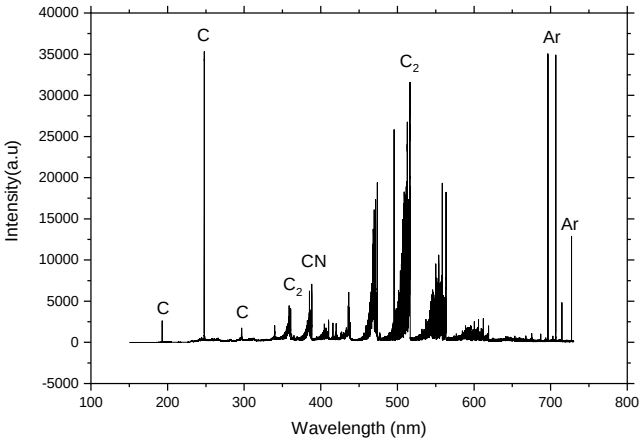

Fig. 1. Emission spectrum from a Ar/CO_2 plasma.

Acknowledgments:

Research co-financed by the Operational Program FEDER 2014-2020 and by the Regional Government of Andalusia within the context of the project Ref. 1380678-F.

References

[1] Snoeckx, R. et al. *Chemical Society Reviews*, **46** (2017), 5805-5863.
[2] Rincón, R. et al. *Plasma Sources Science and Technology*, **24** (2015), 032005.
[3] Usman, M. et al. *Renewable and Sustainable Energy Reviews*, **45** (2015), 710-744.