Towards the (bio)-synthesis of carbon nanostructures: understanding the decomposition of CO_2 in a microwave plasma at atmospheric pressure.

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Biogas is mainly composed of CO_2 and CH_4 and it is produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials, *e.g:* agricultural waste or sewage. Since CO_2 and CH_4 are two of the most important greenhouse gases, biogas emission must be avoided or, at least, converted. In this context, atmospheric pressure plasma technology has shown its potential for the decomposition of both gases [1,2]. However, the use of plasma technology goes beyond the destruction of biogas since it can be tuned to obtain certain nanostructured carbon materials from biogas decomposition [3].

In this work, Ar/CO_2 atmospheric pressure surface wave discharges sustained with a surfatron device at 200 W (2.45 GHz) are researched with the aim of understanding plasma CO_2 decomposition. For that purpose, CO_2 was diluted in different Ar flows in the range 0.5 - 5.0 L/min obtaining CO_2 concentrations up to 1.6%. Mass spectrometry from the exhaust plasma gas (Fig.1.) reveals the formation of O_2 and CO regardless of the experimental conditions. Although, the *m/z* signal at 44 a.m.u points out an incomplete CO_2 decomposition, an 85% decomposition rate was achieved for the lower CO_2 flows. Furthermore, the dependency of the decomposition rate on the amount of CO_2 and not on its concentration in the final gas mixture was found. These results are the starting point in the use of CO_2/CH_4 mixtures to obtain carbon nanostructures by this plasma technology.

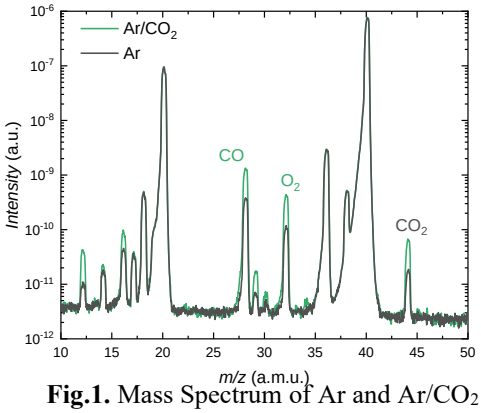

Fig.1. Mass Spectrum of Ar and Ar/CO_2 plasmas gas exhaust. Ar flow of 0.5 L/min and 0.14% CO_2

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