Dielectric Barrier Discharge in CO2: electrical and optical characterization

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Fundamental problems of high pressure discharges

Dielectric Barrier Discharge in CO_2: electrical and optical characterization

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In the past ten years, studies on CO_2 have known a growing interest [1] [2]. Among them, CO_2 recycling [3], design of spacecraft shields for atmosphere re-entry, or oxygen production [4] [5] in the frame of the future Mars missions are of major concern. Non-equilibrium plasmas are an excellent way to induce chemistry in gases. At atmospheric pressure, dielectric barrier discharges (DBD) are widely used to generate cold plasmas, avoiding the transition to the arc regime. Usually, at this pressure, DBDs are filamentary and homogeneous DBD are only reported for few gas compositions such as Nitrogen or noble gases (Ar, He, Ne) with a Penning admixture. In this work, we will present the very first results obtained in a homogeneous dielectric barrier discharge at atmospheric pressure in pure CO_2.

In such conditions, the discharge works in the well-known Townsend regime. The measured current (Fig.1) presents a large peak during one half-period as typically reported in the literature for Atmospheric Pressure Townsend Discharge (APTD). This operating regime is confirmed by optical measurements (Fig. 2), showing that the maximum light is located on the anode side, which is a characteristic of an APTD.

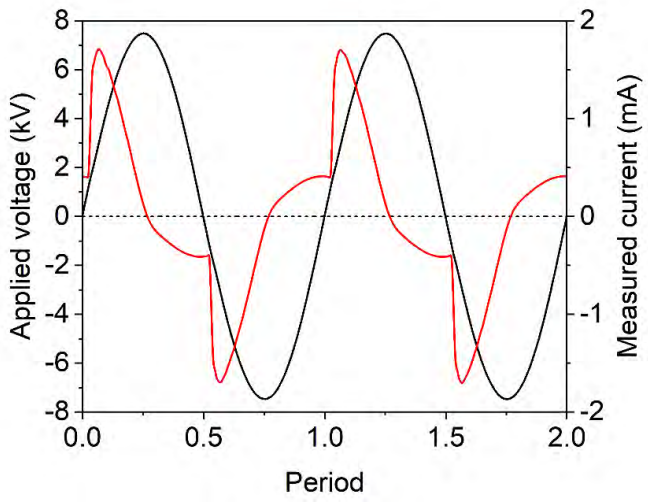

Fig. 1: Voltage and current measured in pure CO_2 DBD at atmospheric pressure.

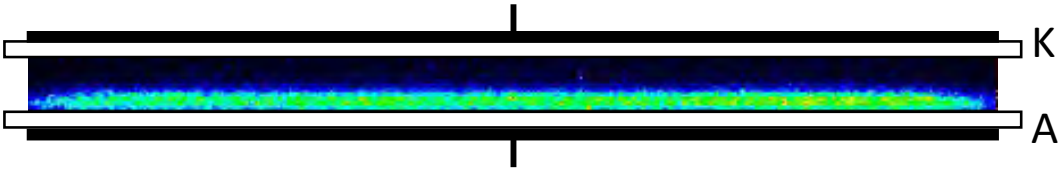

Fig. 2: ICCD image of light emission during one half-period of the applied voltage in pure CO_2 (aperture time=1/4 period).

This work will present the first experimental characterization of the homogeneous discharge in CO_2 using electrical measurements, imaging and optical emission spectroscopy. On the basis of these results, the possible mechanisms involved in this discharge regime will be discussed.

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