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BOOK OF ABSTRACTS

including general information and program

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Multi-hollow surface dielectric barrier discharge: Variations of gaseous products under conditions of various air flow rates and relative humidities

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Evaluation of gaseous products (reactive species) generated by the discharge is crucial for its employment in practical applications especially under ambient air conditions.

In this work, variations of the gaseous products of the multi-hollow surface dielectric barrier discharge (SDBD) in dry air were studied with respect to various discharge powers (1–5 W), air flow rates (0.25–2.4 L/min) and air relative humidities (0–80%). The discharge was generated by a perforated ceramic substrate in a configuration with the air-exposed electrode [1]. A unique geometry allowed the air to pass through holes (hollows) of the substrate inside which the discharge was formed enabling efficient production of several gaseous products. Out of them, production of ozone O_3, nitrous oxide N_2O, nitric oxide NO, nitrogen dioxide NO_2, dinitrogen pentoxide N_2O_5 and nitric acid HNO_3 were evaluated by means of FTIR spectroscopy and UV absorption in terms of concentration (ppm) and production yield (g/kWh).

The work demonstrated a critical impact of both air flow rate and air relative humidity on prevailing discharge mode ("O_3 mode" vs. "NOx mode") and, thus, on production and composition of gaseous products. Whereas the air flow rate particularly determines the air residence time in a zone of generated discharge as well as gas heating, the air relative humidity influences the discharge from physical (processes of discharge formation, propagation, and its characteristics) and chemical aspects (production of H, OH, HO_2 radicals). When the discharge operated in the "O_3 mode", O_3, N_2O, N_2O_5 and HNO_3 were observed among the gaseous products, while with the discharge transitioned to the "NOx mode", N_2O and HNO_3 along with NO and NO_2 were present. In dry air, the threshold of specific input energy (energy density) for a transition of the discharge from "O_3 mode" to "NOx mode" was approx. 1100 J/L, while with an increase of air relative humidity from 20 to 80%, it gradually decreased from approx. 600 to 450 J/L, respectively.

The work demonstrated that when the multi-hollow SDBD is generated under ambient air conditions, it generates various gaseous products in a wide range of concentrations that can be easily regulated by proper working conditions [2]. Therefore, the discharge may eventually find many possible applications, particularly in plasma pollution control and biomedicine.

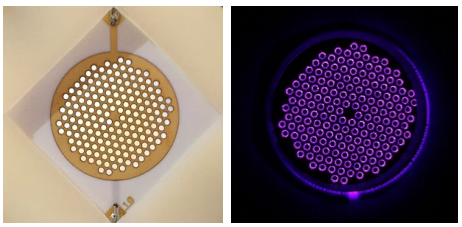

Fig. 1. The photographs of perforated ceramic substrate (left) and multi-hollow SDBD (right).

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