

OZONE SYNTHESIS IN DISCHARGES ON DIELECTRIC SURFACE

Jodzis S.

Warsaw University of Technology, Faculty of Chemistry, Noakowskiego 3, 00-664 Warszawa, Poland

Abstract. The results of studies on the synthesis of ozone in discharges on ceramic dielectric surfaces have been presented in this paper. The profiles that were used in the tests have minute channels, in which the electrodes were placed, directly below the working surface.

1. INTRODUCTION

There is an increasing interest in the use of discharges on dielectric surfaces in processes like ozone synthesis. In general, three kinds of such discharges can be distinguished:

- discharges on surfaces of materials located in the discharge gap [1-3],
- discharges on a dielectric surface [4-6], which is adjacent to the electrodes; these discharges are induced by a flat electrode situated on the other side of the dielectric layer,
- coplanar discharges [4, 7] caused by the interaction of electrodes, which are placed in a dielectric material.

In the last case, the electrodes can be located either on the interface of two dielectric layers, whose electric properties and thicknesses differ, or inside one dielectric material. The latter solution can comprise many microchannels, whose parameters depend on the dielectric constant of the material, its thickness, as well as the shape and size of the electrodes. The prototypes used for ozone synthesis are powered by currents of relatively low frequencies (usually up to 10 kHz).

Hybrid systems are also studied. In them, two types of discharges, for instance barrier and surface discharges, are used simultaneously [8]. It is noteworthy that during surface discharges UV rays are emitted.

The aim of the studies was to investigate the possibility of obtaining discharges in which ozone is effectively generated on dielectric surface. The operating surfaces of the profiles will be used in further studies on catalysed ozone synthesis (in the presence of an active surface layer).

2. EXPERIMENTAL

Experiments were carried out using ceramic (Al_2O_3) profiles [9], whose structure is shown in Fig. 1a. The operating area is 45×33 mm. Each profile contains up to 30 channels, whose diameters are $350 \mu\text{m}$. The channels are situated in 0.85 mm intervals (the distance between the axes of symmetry of the channels), approximately 0.4 mm under the working area (Fig. 1b). The nickel electrodes are in the channels and form discharge pairs (Fig. 2).

The profiles fit tightly in the chamber, due to which the gas was able to flow only through a small gap directly over the operating surface. The system was cooled from both sides by radiators. The studies were carried out in oxygen. The concentration of ozone was measured with BMT-963 VENT. The discharge power was evaluated with a TDS3032 oscilloscope as shown in Fig. 3. Because the power of the discharge was small, the voltage was measured with an H.V. capacitive probe with very high impedance. The electric charge which was flowing through the ozonizer was measured using selected low-loss SMD capacitors with a stable capacity in a wide frequency range. The signals from a capacitive divider ($C_1-C_2-C_{\text{cab}}-C_3$), a serial capacitor C_S , as well as the following equations were used: