1) REMOVAL OF SO_2 AND NO_x FROM FLUE GASES BY A NEW TYPE OF HIGH FREQENCY CORONA BRUSH DISCHARGE

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Abstract. Pulse corona brush discharge (CBD) can be used for cleaning of CO_2 and NO_x from flue gases. In CBD active corona occupies practically the whole volume of discharge tube, so that one may expect a great efficiency of this type of discharge in application, for flue gas cleaning from SO_2 and NO_x.

1. INTRODUCTION

With increase of Industrialization in the world, demands for production of electric energy increase, particularly in developed countries. Presently, a largest amount of electric and thermal energy is produced in fossil fuel thermal plants. Burning of fossil fuels emits info atmosphere flue gases containing sulfur dioxide (SO_2) and nitrogen oxides (NO_x). These pollutants are very harmful for environment. For example, acid rains are caused by presence of SO_2 and NO_x in atmosphere. As a movement of pollutants in atmosphere depends on winds, the problems with them is a global problem of the whole world and mainly does not depend on the location of a pollution source. More about existing methods for cleaning of flue gases, from SO_2 and NO_x is given in [1,2,3].

A now method for simultaneous removal of SO_2 and NO_x from flue gas, a plasma chemistry method called ELFI, has been developed on the basic of fundamental research of the special type of high frequency corona brush discharge (CBD).

2. CORONA BRUSH DISCHARGE

Corona Brush Discharge (CBD) is a new type of a high-frequency corona discharge, and one of the principal characteristics of this discharge is that corona occupies a whole volume between a special brush-shaped electrodes in a discharge chamber [4,5].

The results of the study of the double-sided high-frequency corona brush discharge (DSCBD) when a new type of Tesla coil is used as a power supply - the three-phase Tesla coil (3PTC) [6,7], which gives uniform output voltage in each operating pulse - are presented in this paper.

The-experimental device shown in Fig. l has five brush-shaped electrodes (BE_1-BE_5) placed sequentially in a glass tube (GT) , that is a DSCBD tube. The DSCBD tube is connected to a ventilation system of a capacity up to 150 m3/h. Inner diameter of GT and brush electrodes is 11 cm, and length of GT is also 11 cm.

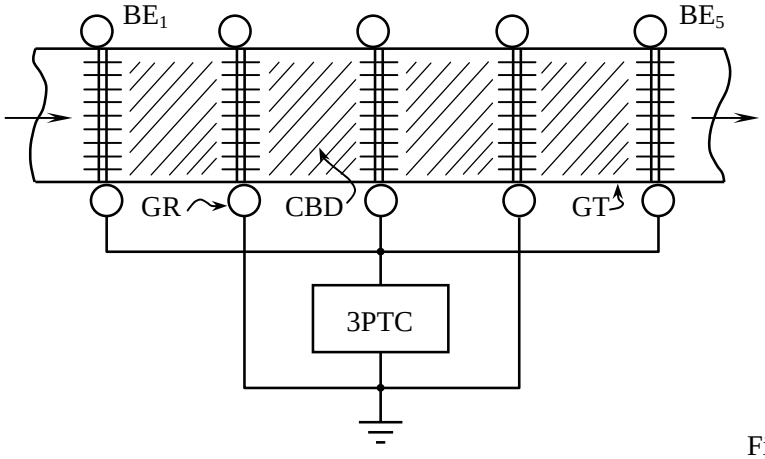

Fig. 1. Experimental device with five brush-shaped electrode.

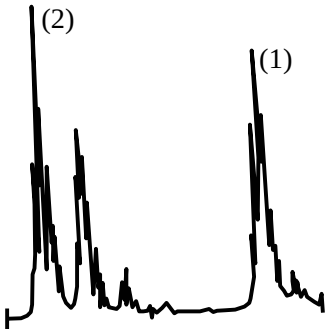

Fig. 2. Part of the CBD spectrum of the N_2 second positive system: (1) 337.1 nm and (2) 357.7 nm. Operating conditie air at atmospheric pressure, TC: U_{TC} = 250 kV, at f = 200 kHz.

Pins of the brush-shaped electrodes are fastened to the electrode mesh (1 line/cm with element wire of 1 mm in diameter). The guard rings (GR) on the electrodes, with theirs cross-sectional radius greater than a critical one, are used for electrostatic shielding to prevent edge breakdown. The electrodes of such construction does not make a considerable obstacle to a flow of operating gas through them. The electrodes BE_1, BE_3, and BE_5 are connected to one (hot) end of 3PTC, while the electrodes BE_2 and BE_4 are connected to another, grounded end of 3PTC.

When 3PTC is energized, corona discharge is established and it completely occupies the space between the all electrodes and emits uniform light from the whole volume of double-sided corona brush discharge. It is to be noted that DSCBD is very stable in the whole volume between electrodes. Characteristics of this discharge are similar to those of corona brush discharge-described earlier [4,5]. In Fig. 2 is shown a part of the DSCBD spectrum for second positive system of N_2 (337.1 nm (1) and 357.7 nm (2)) for air at atmospheric pressure and voltage of 3PTC U≈250 kV at frequency f≈200 kHz. With air-water vapor mixture as operating gas, one gets in discharge nitrogen oxides which with water vapor forms nitric acid.

Pulse brush discharge corona can be used for cleaning flue gases from SO_2 and NO_x. In, CBD active corona occupies practically the whole volume of discharge tube, so that one may expect a great efficiency of this type of discharge in application for flue gas cleaning from SO_2 and NO_x.

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