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Experimental Study of Evolution of NO and NO_2 In a Positive Corona Discharge

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Abstract. In this work, we present an experimental study of the reduction of NO and the creation of NO_2 by positive corona discharge in N_2/O_2 mixture (95% N_2, 5%O_2), where 200ppm of NO are injected at atmospheric pressure. The corona discharge was generated using a wire- to- cylinder reactor. The applied voltage is 5kV and 7 kV and it was maintained for ≈ 50 minutes. Ultraviolet absorption spectroscopy operating in the wavelength range 190-330 nm was used to identify the species and quantify their concentration, According to Beer Lambert law who give concentration from absorbance. The temperature was maintained constant for 300K. The obtained resultant show nitrous oxide NO has been destroyed with the augmentation of corona current. We note different times to NO removal, 50 minutes at 5 kV and 20 minutes at 7 kV. And we observe the creation of NO_2 and the apparition of ozone O_3.

Introduction

Nitrogen oxides are atmospheric pollutant that are emitted in industrial and car exhaust, has motivated many researchers on the study of the behaviour of nitrogen oxides [1]; in this way there have been several conventional methods to remove the NO: selective catalytic reduction, selective non-catalytic reduction and non-selective catalytic reduction. Recently, as a new and more effective method for NO removal, the low temperature plasma process has been developed and investigated actively by many researchers [2-3]. In the low temperature plasma process, most of the electrical energy goes into the production of energetic electrons. The energetic electrons produce the free radicals responsible for the decomposition of pollutants [4].
There are also different types of electrical discharges for nitrogen oxides removal.
In fact Corona discharge at atmospheric pressure has been used for a long time to charge surfaces, in electrostatic precipitators [5-6], and more recently in the removal of toxic components from industrial flue gases [7].
The study of corona discharge involves both physical and chemical aspects [8-9],this discharge can provide energetic electron , that are capable of breaking nitrogen and oxygen molecules into atoms, which can later react to several nitrogen oxides, such as NO, NO_2, N_2O and ozone O_3.[10-11-12].
In this paper, we report experimental investigation of the comportment evolution's of NO and NO2 by positive corona discharge in N_2+O_2+NO mixture of 95% N_2, 5%O_2 where 200 ppm of NO are injected. The change in concentration was studied for two discharge voltages, 5 and 7 kV. Species concentrations are determined by means of UV absorption spectroscopy, in the range of wavelengths 190-330nm.