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# Reduction of Nitrogen Oxide Using Ammonia Radicals Prepared by Intermittent Dielectric Barrier Discharge

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Non-thermal plasma processes have attracted attention to de-NOx because of their high removal efficiency and cost effective process, where the plasma-induced radicals efficiently convert NOx into harmless gases such as $N_2$, $O_2$, and $H_2O$ and useful matters. In the present study, a method of radical injection was used, where the ammonia radicals were externally generated by a dielectric barrier discharge (DBD) in a separate chamber of a small volume, and were injected into NOx gas stream field to reduce NOx molecules. NO in $N_2$ gas was reduced by the ammonia radicals.

The plasma is generated at a gap with a coaxial electrode configuration using one-cycle sinusoidal (OCS)-wave power source to accomplish high removal and energy efficiencies. The repetition rate of plasma generation was 5–50 kHz and the output peak-to peak voltage of the power supply was 2–20 kV. The dependence on the discharge power was measured by varying the repetition rate and applied voltage. The maximum energy efficiency, 140 g/kWh, was obtained at small values of the $NH_3$ concentration and the discharge power. It was found that the both NO removal rate and energy efficiency were correlated by the product of excited power per unit volume and ammonia residence time in the plasma reactor. Experiments were also made to obtain higher energy efficiency for various gap lengths of DBD source on optimal gas flow rate and applied voltage for de-NOx.

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# Ozone Generation in an Atmospheric Pressure Micro-Plasma Jet in Air

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Microhollow cathode discharges (MHCDs) offer the possibility to generate non-thermal plasmas in atmospheric pressure gases, including air, by relatively simple means [1]. The MHCD plasma results from a direct current discharge between two molybdenum electrodes (0.25 mm thick) that are separated by an alumina insulator of the same thickness. A tapered discharge channel is drilled through all layers, leaving a 0.2 mm wide opening in the cathode and an opening of ~0.1 mm in diameter in the anode. By flowing air at atmospheric pressure through this hole, a plasma jet with typical dimensions of millimeters in the axial direction is generated. The gas temperature of the jet can be controlled by varying the gas flow rate. At high flow rates (>0.2 L/min), gas temperatures close to room temperature have been measured by means of micro-thermocouples. The cold plasma was found to be a source of ozone as measurements of the ozone concentration using absorption spectroscopy at the mercury lamp wavelength (253.7 nm), and iodometric titration show. At an air flow rate of 0.4 L/min, we found >1000 ppm ozone in the exhaust stream. Besides serving as an ozone source, the cold plasma jet has the potential for applications such as surface treatment of organic [2] and other heat sensitive materials, and plasma surgery [3].

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