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Title	Study on Gas Cleaning using Non- thermal discharge plasma (非平衡放電プラズマを用いたガス浄化技術に関する研究)

The non- thermal discharge plasma technique has been studied as an innovative approach to NOx removal for automobile exhaust, especially, for the diesel engine exhaust. Some problems for making this technique practical still exists, such as the difficulties in measurement of intermediate products and the reductive removal of NOx without externally added reducing agent, and delays the growth. In this work, the experimental studies and the numerical calculations were employed to find the solution of above problems.

CO oxidation monitoring method was numerically and experimentally investigated for the measurement of OH radicals in the atmospheric pressure pulsed discharge plasma of H_2O/Ar mixtures in Chapter 3. The influences of the discharge on the CO dissociation could be ignored within SIE (Specific Input Energy: Discharge energy dissipated in unit volume of the gas) = 9J/L. The production of OH radicals decreased by 10% when 1% CO was used as the probe for OH measurement. Influences of the loss-reactions of OH radicals and the dissociation of CO_2 due to discharge are negligible when the CO concentration was in the range from 2000ppm to 1%. Within this experimental condition, the total amount of OH radicals is identical to that of CO_2. The influence of the dissociation of CO_2 caused by the succeeding discharges can be ignored when the residence time was smaller than 0.5sec (120 pulses) in this experiment. In the pulsed discharge plasma of H_2O/Ar mixture, under the conditions with the SIE value of 9J/L and H_2O content of 1.5%, OH radical concentration was 30ppm (9.4×10^{14} cm^{-3}) per single pulse. In the temperature range investigated in this study (50- 150 degree C), concentration of OH radicals increased with the SIE value and with the content of H_2O. The concentration of OH radicals decreased with increasing gas temperature.

In Chapter 4, the removal of NO using the pulsed discharge plasma and the electrophoresis was experimentally investigated using simulated gas of $NO/O_2/N_2$. The experimental results show that the activity of the adsorbents can be restored by the electrophoresis. This result is caused the fact that by the movement of nitrate ions and the sodium ions using the electrophoresis, resulting in the increase of the concentration of adsorbed NOx. It means that the adsorbed NOx was moved from the adsorption zone using electrophoresis and it was condensed to the anode side.

If oxygen concentration is kept low in the anode side, the concentrated nitrate ions can possibly be reduced. An experiment was carried out to compare the 2 types of adsorbents, the gamma alumina and the molecular sieves of 13X. The result shows that the efficiency of NOx adsorption and the conductivity during the electrophoresis depend on the characteristic of the adsorbents. The efficiency of NOx adsorption and the conductivity of the molecular sieves of 13X were higher than those of gamma alumina. The energy consumption of the electrophoresis decreased when the molecular sieves of 13X was used instead of the gamma alumina. The adsorption of NO_2 and HNO_3 of the molecular sieves of 13X, however was influenced by the remaining water. From the results, this method can be used for reduction of NOx.