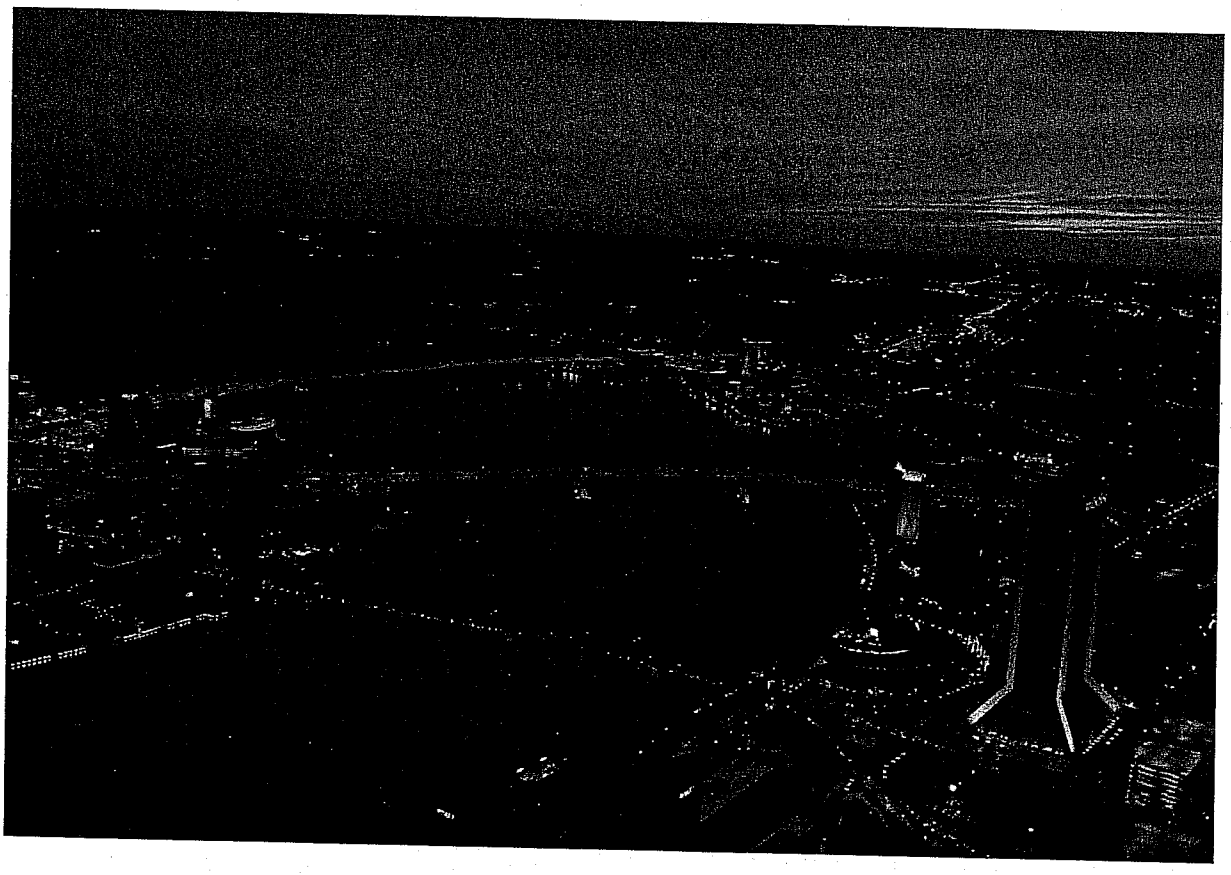
AOTs-18

The 18th International Conference on

Advanced Oxidation Technologies for Treatment of Water, Air and Soil

ABSTRACTS



Crowne Plaza Riverfront, Jacksonville, Florida, USA
November 11 – 15, 2012

Reaction Mechanisms of DeNOx in Radical Injection System Using DBD

Shinji Kambara
Gifu University, Environmental and Renewable Energy Systems Division
1-1 Yanagido, Gifu, 501-1193, Japan

To broaden and lower the narrow temperature window of the selective non catalytic reduction (SNCR) of nitric oxide (NO), the use of activated ammonia as the reduction agent was examined. A pulsed DBD (dielectric barrier discharge) plasma was employed as the excitation source for molecular ammonia. Activated ammonia generated by the pulsed DBD was injected into a model flue gas ($NO/O_2/N_2$) at room temperature. The effects of reaction temperatures, oxygen concentrations, and NH_3/NO molar ratios (MRs) on NO removal were investigated in a lab-scale plug flow reactor. Temperatures ranged from 500 °C to 850 °C. A temperature window enlargement of 150 °C was achieved at the lower boundary of the temperature window. The results are the first clear observations of low temperature SNCR by activated ammonia. Above 600 °C, NO removal was affected by injection of activated ammonia, while around 750 °C, conventional SNCR by injection of molecular ammonia was effective. An approximate 80% NO removal was attained at 700 °C with an MR = 2.0 and 8.3% O_2. The chemical compositions of activated ammonia was measured by mass spectrometry to be clear the reaction mechanisms of $DeNO_x$ in radical injection systems. The results suggested that effective chemical species for NO removal such as NNH and H_2 were produced in the DBD reactor.

A simulation gas of the activated ammonia (NH_3+H_2) was prepared to be clear the contribution of hydrogen, and the $DeNO_x$ performance of the simulation gas was examined. It found that hydrogen has the role of enlargement of temperature window in $DeNO_x$ reaction. DeNOx mechanisms were concerned using elementary reaction analysis based on Miller & Bowman mechanism. It was clear that formation of HNO and NH from hydrogen in the activated ammonia promoted $DeNO_x$ reaction at low temperature.

Index Terms — Dielectric barrier discharge, nitrogen oxide, DeNOx, ammonia, hydrogen, radical injection.