Reaction Mechanism of NO Removal by 172nm Irradiation

Satsuki Ebata and Shinji Kambara*
Gifu University, Energy Engineering Division, Graduate school of engineering
1-1 Yanagido, Gifu, 501-1193, Japan
*kambara@gifu-u.ac.jp

An innovative selective non-catalytic reduction reacting at a low temperature has been desired for ship exhausts to observe strict NO_x regulation. Photochemical NO_x removal without reduction agent (NH_3) by vacuum ultraviolet irradiation of a 172 nm wavelength is a promising technique. The dominant reactions in the photochemical reactions were investigated in detail by the small-scale photochemical reactor as shown in Fig. 1 using a model gas mixture such as NO, NO-O_2, NO-H_2O, and NO-H_2O-O_2 system. In NO, NO-O_2, and NO-H_2O system, NO concentration was gradually decreased, while NO_2 was formed by oxidation of a part of NO. Contrary, in NO-H_2O-O_2 system, NO concentration was rapidly decreased as shown in Fig.2, and NO_2 concentration was low levels. The maximum amount of NO removal in NO-H_2O-O_2 gas system was examined for practical use by the large-scale photochemical reactor: it was 0.72 g-NO/h at 99% NO removal. The reaction mechanism was considered by elemental reaction simulation.

Index Terms — NO_x removal, Vacuum ultraviolet, Selective non-catalytic reduction

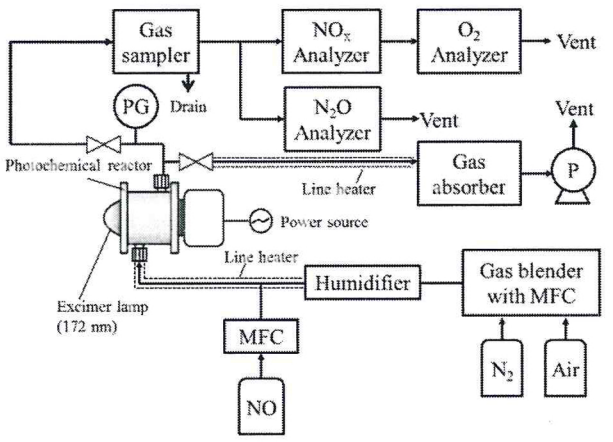

Fig. 1 Experimental setup for NO removal by irradiation of 172 nm wavelength.

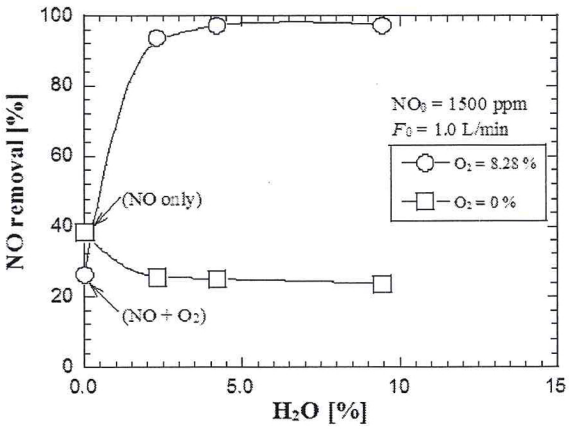

Fig. 2 Effect of H_2O% on NO removal in NO-H_2O-O_2 gas mixture.