SDEWES2016.0589 **NOx Removal by 172 nm VUV Irradiation at Room Temperature**

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Abstract

Removal of nitrogen oxides (NO_x) from flue gas emitted from stationary combustors is desirable for environmental pollution control and public health. In Japan, strict emission limits are in place for all stationary sources, including small-scale combustion plants such as waste incinerators. Selective catalytic reduction (SCR), an efficient treatment technology, has been used world-wide for NO_x removal in large-scale combustors such as coal-fired power plants. In SCR systems, nitric oxide (NO) reacts with injected molecular ammonia in the presence of a catalyst and oxygen at a temperature of around 350 °C at which NO converts to molecular nitrogen and water. A drawback of SCR systems in application to waste incinerators is that they are particularly costly because frequent replacement of the catalyst is required owing to catalyst poisoning by sulfur dioxide, plugging and erosion by ammonium bisulphate, and deposition of ash, amongst others.

We have been developed an original deNOx reactor using vacuum ultra violet (VUV) of 172 nm wavelength. The advantages of this deNOx system are no catalyst, ammonia free, and low temperature reaction at room temperature. In this study, reaction mechanisms of NOx removal by the VUV were investigated in experimetal and elemental reaction simulation. To find a rate-controlling reaction step on NOx removal, the following four reaction systems were examined:

1) NO/N_2

2) $NO/H_2O/N_2$

3) $NO/O_2/N_2$

4) $NO/O_2/H_2O/N_2$

It found that high NO removal rate was obtained at the $NO/O_2/H_2O/N_2$ system only. Both O_2 and H_2O were necessary for a high NO conversion to HNO_3. In particular, the partial pressure of H_2O was needed above 4.24 kPa for efficient HNO_3 production. Important eight reactions were estimated.