

2.050 Pressure Studies of the Reaction of HO₂ with NO₂ using a mid-infrared Continuous Wave Quantum Cascade Laser.

Early Career Scientist

Presenting Author:

JUNTING QIU, Department of Environment Systems, Graduate School of Frontier Sciences, The University of Tokyo, Kashiwanoha 5-1-5, Kashiwa, Chiba 277-8563, Japan, paziqjt@gmail.com

Abstract:

The hydroperoxy radical (HO₂) is an important intermediate in both stratospheric and tropospheric chemistry. In polluted atmospheres, its reaction with NO₂ forms peroxy nitrates (HO₂NO₂), which is a reservoir of HO_x and NO_x. If the HO₂NO₂ lifetime is long enough they may act either as a sink, transporting NO_x, or may react with OH, effectively removing HO₂ radicals.

UV absorption spectroscopy has been the most commonly used method to detect the HO₂ radical in the range 220~230 nm, because of its strong cross sections ($\sigma \approx 10^{-18}$ cm² molecule⁻¹). However, the broad and structureless absorption of HO₂ in this region due to the predissociative B²A'' ← X²A'' transition leads to overlaps with the absorption of other species, such as hydrogen peroxide ($\sigma \approx 10^{-19}$ cm² molecule⁻¹), the main product of the HO₂ self-reaction.

Recently, the pressure dependency of the rate coefficient for HO₂ + NO₂ was studied with a time resolved laser-induced fluorescence (LIF). Based on the results of this research, the values of the rate coefficient for HO₂ + NO₂ ranged from 50~400 Torr at a temperature 298 K, are obviously higher than previous determined ones by the rate coefficient for HO₂ + NO₂.

In this work, we applied a mid-infrared cw quantum cascade laser as the spectroscopic light source, and measured the rate coefficients for HO₂ + NO₂ with the pressure varied in the range of 0~150 Torr at a room temperature 298 K, and supported the previous result decided by a LIF. The effect of HO₂ + NO₂ has been underestimated, especially in low pressures.