

QUANTUM DIFFUSION CONTROLLED CHEMISTRY: THE H + NO REACTION

MORGAN E. BALABANOFF, DAVID T. ANDERSON, *Department of Chemistry, University of Wyoming, Laramie, WY, USA.*

In this study, we present Fourier transform infrared spectroscopic studies of the 193 nm photochemistry of nitric oxide (NO) isolated in a parahydrogen (pH₂) matrix over the 1.7 to 4.3 K temperature range. Back in 2003 Fushitani and Momose^a showed that hydrogen atoms (H atoms) are produced as by-products of the 193 nm photo-initiated reactions of NO trapped in solid pH₂. We recently published^b a further study on the same NO/pH₂ system where we showed that H atom reactions with NO produce both HNO and NOH even though the reaction that forms HNO is barrierless and the reaction that forms NOH has a sizeable barrier. Further, we measured the reaction kinetics at 1.8 K and 4.3 K and showed the rate constants follow an Arrhenius-behavior with a small activation energy ($E_a=2.39(1)$ cm⁻¹). In the present studies we are continuing this work using a ¹⁵NO enriched sample and are focusing on how we can adjust the experimental conditions to increase the yield of both the HNO/NOH reaction products. We are also performing kinetic experiments at more than just two temperatures to better characterize the temperature dependence of the extracted rate constants. We are conducting these additional experiments to benchmark the reaction kinetics for the H + NO reaction in solid pH₂ to better understand what factors influence the rates of these low temperature chemical reactions.

^aM. Fushitani, T. Momose, *Low Temp. Phys.* **29**, 985-988 (2003).

^bM. Ruzi, D.T. Anderson, *J. Phys. Chem. A* **119**, 12270-12283 (2015).