HYDROGEN ATOM QUANTUM DIFFUSION-LIMITED REACTION KINETICS OF $\mathrm{H + CO \rightarrow HCO}$ IN SOLID PARAHYDROGEN: UNEXPECTED RESULTS

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Our group recently showed that the rate constant for the diffusion-limited $\mathrm{H + N_2O}$ reaction in solid parahydrogen ($\mathrm{pH_2}$) is inversely related to the $\mathrm{N_2O}$ concentration.[a] This finding was rationalized by the idea that chemical impurities disrupt the long-range order of the crystal and slow the H-atom quantum diffusion rate. We investigated this finding further by studying the $\mathrm{H + CO \rightarrow HCO}$ reaction in solid $\mathrm{pH_2}$. To explore how the reaction rate constant depends on the CO concentration, we prepared solid $\mathrm{pH_2}$ matrix samples co-doped with CO and $\mathrm{Cl_2}$ using the Rapid Vapor Deposition technique,[b] H-atoms are produced *in situ* using a UV-IR method described previously.[c] We performed kinetic studies at $1.56(3)$ and $4.00(2)$ K with a range of CO concentrations ($10 - 250$ ppm). We observe a similar inverse relationship between the rate constant and the CO concentration. Furthermore, it looks like the rate constant decreases from $1.56(3)$ to $4.00(2)$ K. This work is ongoing, and the latest results and analysis will be presented at the meeting.

[a] F. M. Mutunga *et al.*, J. Chem. Phys **154** (2021) 014302.

[b] M. E. Fajardo and Simon Tam, J. Chem. Phys. **108.10** (1998) 4237.

[c] S. C. Kettwich, P. L. Raston, and D. T. Anderson, J. Phys. Chem. A **113** (2009) 7621.