COLD CHEMICAL REACTIONS OF H-ATOMS AND N_2O IN SOLID PARAHYDROGEN AT 2 K

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We report on the results of chemical reactions of H-atoms with N_2O in solid parahydrogen matrices investigated by rapid scan FTIR. The reaction is initiated by the 193 nm in situ photodissociation of N_2O to produce N_2 + $O(^1D)$. We assume the $O(^1D)$ photoproduct reacts with the parahydrogen host to create H-atoms. What we observe is growth of cis-HNNO right after photolysis is stopped along with a later delayed growth in trans-HNNO. We assign our peaks by comparison with a previous Xe matrix isolation study[a] and recent ab initio calculations[b] of the anharmonic vibrational frequencies and isotopic shifts. We performed some experiments using the $^{15}N_2^{18}O$ precursor molecule. Detailed study of the reaction kinetics indicate that at 1.8 K the cis-isomer is formed exclusively by the reaction, but then converts to the lower energy trans-isomer with time. These results are surprising because a 40 kJ/mol barrier is predicted for the H + N_2O reaction, yet the reaction readily proceeds even at 1.8 K. We are currently studying this reaction under a variety of conditions and the most current results and analysis will be presented.

[a] S. L. Laursen, A. E. Delia, and K. Mitchell, *J. Phys. Chem. A* **104**, 3681-3692 (2000).
[b] K. A. Petersen and J. S. Francisco, *J. Chem. Phys.* **134**, 084308 (2011).