INFRARED INDUCED REACTION OF ATOMIC CHLORINE WITH SOLID PARAHYDROGEN

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The Cl + H_2 $\rightarrow$HCl + H reaction has been studied in solid parahydrogen (pH_2) via FTIR spectroscopy of the HCl product. Atomic Cl is generated in solid pH_2 from the *in situ* photodissociation of Cl_2 at 355 nm. The trapped Cl atoms are too cold to react with the surrounding pH_2 matrix at liquid helium temperatures given the reaction has a barrier of $\sim$ 5 kcal mol^{-1}. The hydrogen abstraction reaction can not even proceed via quantum mechanical tunneling since the reaction is endothermic by approximately 360 cm^{-1}, which is too great at temperatures of 2-4 K. The reaction can be triggered by allowing IR light from the FTIR spectrometer to impinge upon the Cl atom doped pH_2 solid. Spectra can be recorded with and without a long bandpass filter present in the IR beam which filters out light above 3900 cm^{-1}. With the filtered light, repeated scans show no evidence for growth of the HCl $R_1(0)$ feature and thus no reaction. However, when the filter is removed the HCl absorption grows in intensity signaling the onset of reaction. The integrated absorbance of the HCl feature as a function of time can be fit to a simple first-order rate equation that indicates the Cl atoms have a half-life of 100 minutes under these conditions. We speculate that the reaction is due to solid pH_2 absorptions that occur above 4100 cm^{-1}, launching H_2 vibrational excitons (vibrons) into the solid which scatter off the Cl atoms and induce reaction. These experiments are ongoing and the most recent results will be presented at the meeting.