Low Temperature Measurements of Electron Attachment to $POCl_3$

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The solution phase chemistry of phosphorous trichloride ($POCl_3$) is well characterized as this molecule is used in a number of industrial processes including the synthesis of important organophorous compounds [1], such as flame retardants, plasticizers, insecticides and fuel additives. However, the gas phase chemistry of $POCl_3$, including the ion-molecule and electron-molecule reactions, has not been well studied especially at low temperatures despite the fact that the pure substance have relatively high vapor pressure. In the present work, we have investigated the reactivity of $POCl_3$ with thermal electrons and have measured their attachment rate constants at different temperatures in a low density plasma ($\sim 10^9$ cm^{-3}) using the CRESU technique. This reaction displays at low temperature (39K-170K), a high rate constant of $\sim 10^{-7}$ cm^3 $molecule^{-1}s^{-1}$ and is a relatively temperature dependent in our temperature range [2]. Electron attachment to $POCl_3$ is a rich process in which a non-dissociative channel ($POCl_3^-$) competes with a dissociative one ($POCl_2^-$) [3]. We have shown that the main product at low temperature ($\leq$170K) is $POCl_3^-$, which is the non dissociative channel, where the reaction is governed by termolecular collisions. At higher temperature it is rather the dissociative one which prevails confirming others studies at higher temperatures [3-6].

References

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