trans-$CF_3CH=CHCl$: Temperature Dependent OH Rate Coefficients and Global Warming Potential

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trans-$CF_3CH=CHCl$ is a proposed replacement compound for chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) with a possible industrial use as a foam blowing agent. For replacement compounds to be environmentally acceptable, their ozone depletion potentials (ODPs) and global warming potentials (GWPs) need to be negligible. In order to quantify ODPs and GWPs the atmospheric lifetimes and infrared absorption cross sections of the replacement compound are required. The primary atmospheric loss process for *trans*-$CF_3CH=CHCl$ is expected to be its gas-phase reaction of hydroxyl radical, OH

$$OH + \textit{trans}\text{-}CF_3CH=CHCl \rightarrow \text{products} \qquad (1)$$

Reaction (1) is expected to proceed predominately via addition of the OH radical to the carbon-carbon double bond at both the central and terminal carbon sites. In this work, rate coefficients, $k_1(T)$, for reaction (1) were measured between 213 and 376 K at 25–100 Torr (He/N_2). Rate coefficients were measured under pseudo-first-order conditions in OH with OH produced by the 248 nm pulsed laser photolysis of H_2O_2, HNO_3, or $(CH_3)_3COOH$. OH loss was monitored using laser-induced fluorescence. $k_1(T)$ was found to be independent of pressure over this range with $k_1(296\ K) = (3.76 \pm 0.35) \times 10^{-13}$ cm^3 $molecule^{-1}$ s^{-1}. The quoted uncertainties in $k_1(T)$ are at the 2σ (95% confidence) level and include estimated systematic errors. The atmospheric lifetime of *trans*-$CF_3CH=CHCl$ was determined to be ~34 days, although the actual atmospheric lifetime for such a short-lived molecule will depend on the location and season of its emission. The infrared absorption spectrum of *trans*-$CF_3CH=CHCl$ was measured in this work and the GWP of *trans*-$CF_3CH=CHCl$ calculated. The present results will be compared with results from a previous room temperature study[1] and the reactivity of other halogenated propenes. The atmospheric implications of this work will also be discussed.

References

(1) Sulbaek Andersen, M.P.; Nilsson, E.J.K.; Nielsen, O.J., Johnson, M.S., Hurley, M.D., Wallington, T.J. *J. Photochem. and Photobio. A, Chem.* **2008**, 199, 92-97.