

Perfluoro-*N*-methylmorpholine (C₅F₁₁NO), a Persistent Greenhouse Gas: Laboratory Determination of Radiative Efficiency, Atmospheric Loss Processes and Global Warming Potential

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Perfluoro-*N*-methylmorpholine (PF-*N*-MM, C₅F₁₁NO) belongs to the class of morpholines which are used in heat transfer fluids. Its use and high vapor pressure (~270 Torr at 298 K) may lead to its direct emission into the atmosphere. The atmospheric loss processes and lifetimes for PF-*N*-MM over the different atmospheric regions (troposphere, stratosphere and mesosphere) are not well-defined. PF-*N*-MM is expected to be an atmospherically long-lived compound with a lifetime greater than 500 years. Additionally, PF-*N*-MM is expected to be a potent greenhouse gas due to its strong infrared absorption in the atmospheric window region. Fundamental studies of the environmental impact of PF-*N*-MM are required to identify and quantify its spectroscopic and chemical properties.

In this study, the infrared absorption spectrum of PF-*N*-MM was measured and its radiative efficiency (RE) evaluated. The infrared spectrum was measured using Fourier transform infrared spectroscopy between 500-4000 cm⁻¹ and radiative efficiency was calculated using the Hodnebrog et al. (2013) estimation method. Atmospheric loss processes, O(¹D) reactivity and ultraviolet photolysis, were measured as part of this work, leading to an estimation of the PF-*N*-MM atmospheric lifetime based on 2-D model calculations. Potential atmospheric loss processes, atmospheric lifetime, global warming potential (GWP) of PF-*N*-MM will be discussed.

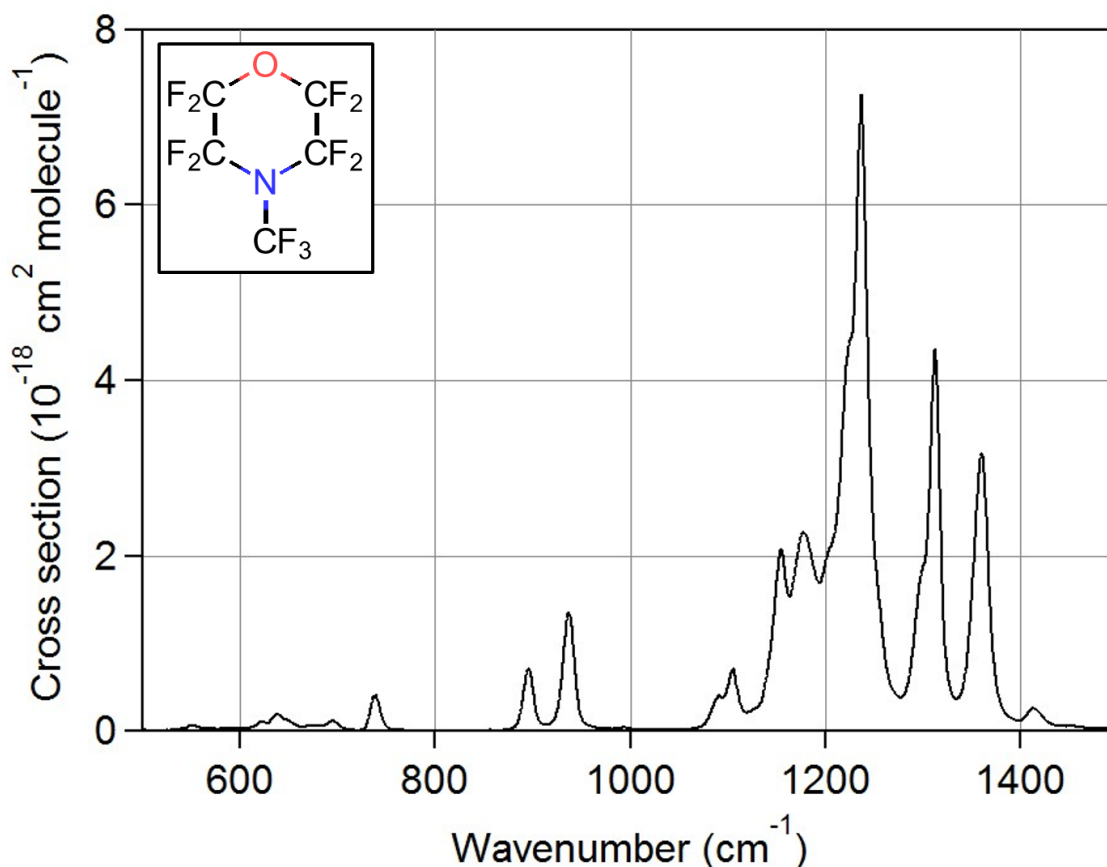


Figure 1. Measured infrared absorption spectrum (base *e*) of perfluoro-*N*-methylmorpholine (PF-*N*-MM).