4.009 Evaluation of Ozone Depleting Substance Replacement Compounds: OH rate coefficients, infrared spectrum, and global warming potentials of (E)-(CF3)2CFCH=CHF (HFO-1438ezy(E)).

Presenting Author:
James Burkholder, NOAA, ESRL/CSD, Boulder, CO,
James.B.Burkholder@noaa.gov

Co-Authors:
Vassileios Papadimitriou, University of Crete, Department of Chemistry

Abstract:

The Montreal protocol and its amendments and adjustments have regulated the phase-out of ozone depleting substances (ODSs) due to their adverse effects on the stratospheric ozone layer. In parallel to the phase-outs, ODS replacements have been proposed that are intended to be less harmful to the environment following their release into the atmosphere during production and use. Hydrofluoroolefins (HFOs) represent the "next generation" of replacement compounds in applications such as fire suppression, heat transfer, blowing, and refrigeration. HFOs are attractive replacement compounds because the presence of the carbon-carbon double bond leads, in general, to a short atmospheric lifetime, which is a key metric in determining their environmental and climate impact. Laboratory evaluations of a replacement compounds atmospheric loss processes is, therefore, a key element in the evaluation of the environmental suitability of a replacement compound.

In this work, rate coefficients for the gas-phase reaction of the OH radical with (*E*)-$(CF_3)_2$CFCH=CHF ((*E*)-1,3,4,4,4-pentafluoro-3-(trifluoromethyl)-1-butene, HFO-1438ezy(*E*)) were measured using a pulsed laser photolysis-laser induced fluorescence technique (PLP-LIF) over a range of temperature (214–380 K) and pressure (50–450 Torr, He or N_2 bath gas) and with a relative rate method at 296 K at pressures between 100 and 400 Torr (synthetic air). The atmospheric lifetime of HFO-1438ezy(*E*) was estimated to be ~36 days with respect to OH reactive loss and it is thus considered a very short-lived substance (VSLS). Its actual lifetime will, therefore, depend on the time and location of its emission. The infrared absorption spectrum of HFO-1438ezy(*E*) was also measured as part of this work. In addition to the experimental measurement results, the radiative efficiency, global warming potentials (GWPs), and photochemical ozone creation potential (POCP) of HFO-1438ezy(*E*) will be presented.