A photochemical reactor for studies of atmospheric chemistry

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A photochemical reactor for studies of atmospheric kinetics and spectroscopy has been built at the Copenhagen Center for Atmospheric Research. The reactor consists of a vacuum FTIR spectrometer coupled with a 100 liter quartz cylinder with multipass optics mounted on electropolished stainless steel end flanges, surrounded by UV-A, UV-C and broadband sun lamps in a temperature-controlled housing. The combination of quartz vessel and UV-C lamps allows higher concentrations of $O(^1D)$ and OH radicals than can be generated by similar chambers. The reactor is able to produce radical concentrations of ca. 8×10^{11} cm^{-3} for OH, 3×10^{6} cm^{-3} for $O(^1D)$, 3.3×10^{10} cm^{-3} for $O(^3P)$ and 1.6×10^{12} cm^{-3} for Cl. The reactor can be operated at pressures from 10^{-3} to 10^{3} mbar and temperatures from 240 to 330 K. As a test of the new system we have studied the reaction $CHCl_3$+Cl using the relative rate technique and obtain a relative reaction rate of $k_{CHCl3+Cl}/k_{CH4+Cl} = 1.03 \pm 0.11$ for the reaction, in good agreement with the accepted value.

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