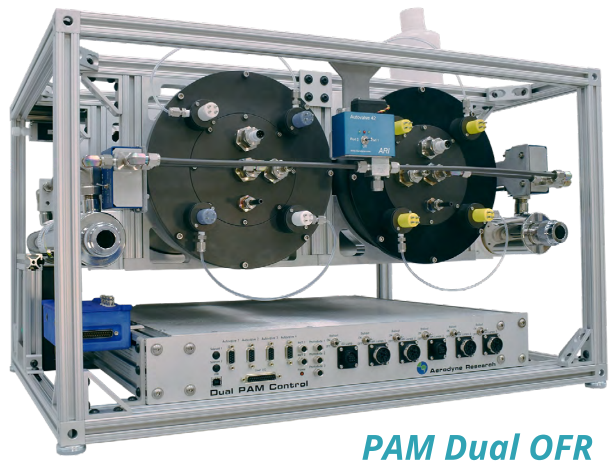
AerodyneResearch

Technology Enhancing Science

PAM

Potential Aerosol Mass Dual / Triple Oxidation Flow Reactor

A highly oxidizing environment that simulates multiple oxidation processes in parallel on timescales of days in the atmosphere in minutes in real time



PAM Dual OFR

Applications

- Laboratory or field studies of secondary aerosol generation via gas-phase oxidation of gas-phase precursors
- Heterogenous oxidation of primary aerosols
- Compatible with gas and particle mass spectrometry techniques
- Complement to laboratory smog chamber techniques commonly used to generate secondary organic aerosol (SOA)

PAM Triple OFR

Advantages

- Extends applications of the PAM OFR by providing the ability to simulate multiple oxidation processes in parallel
- Configurable to input different precursors into OFRs using the same oxidant, or the same precursor into OFRs using different oxidants
- Field deployable
- **Oxidants:** O_3, OH, NO_3, Cl, Br
- Dimmable UVC, UVB or UVA lamps
- Oxidant concentrations that are 100 to 10,000 times larger than in the daytime troposphere, simulating days of atmospheric oxidation in minutes

Potential Aerosol Mass (PAM) Dual / Triple Oxidation Flow Reactor

Specifications

Example Oxidant Configurations

- OH-OH, OH-NO_3, OH-Cl, OH-Cl-NO_3, OH-Cl-Br
- Hours to days of equivalent atmospheric oxidative aging at 100 sec residence time

Components/Available Options

- OFRs with UVC/UVB/UVA lamps
- Humidifier
- Ozone generator
- Nitrate radical generator
- Gas analyzers (ozone, chlorine, nitrogen dioxide)
- UV & RH/T sensors
- Switching valves
- Flow controllers
- Syringe pumps

Size/Weight

Dual PAM

- 24" x 30.5" x 18" (L x W x H); 130 lbs
  [61 cm x 78 cm x 46 cm; 59 kg]

Triple PAM

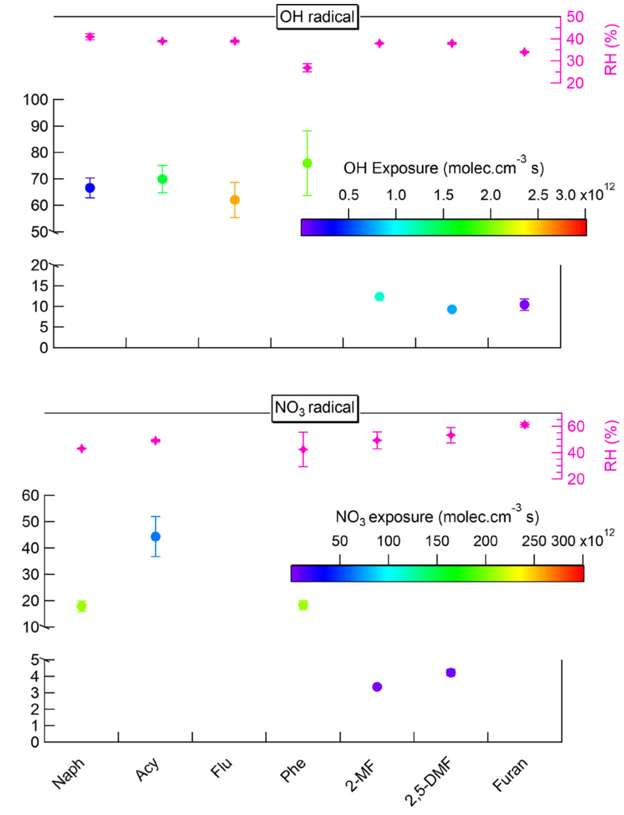
- 24" x 42" x 18" (L x W x H); 170 lbs
  [61 cm x 107 cm x 46 cm; 77 kg]

Electrical

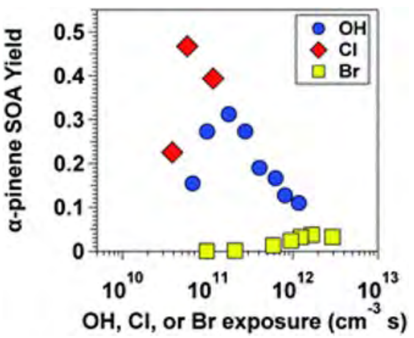
- 225 Watts max, 110-220 VAC, 50-60 Hz

Required Accessories

- N_2 purge gas for UV lamps
- Carrier gas
- Instrument and makeup flows
- Windows PC



Comparison of SOA yields obtained from OH and NO_3 oxidation of select polycyclic aromatic hydrocarbons and furans (El Mais et al., Atmos. Chem. Phys., 2023).



Comparison of SOA yields obtained from OH, Cl, and Br oxidation of α-pinene (Lambe et al., Environ. Sci. Atmos., 2022).

PUBLICATIONS

B. J. Sumlin, E. C. Fortner, A. T. Lambe, N. Shetty, P. Liu, F. Majluf, J. E. Krechmer, C. Daube, S. C. Herndon, and R. K. Chakrabarty. Diel Cycle Impacts on the Chemical and Light Absorption Properties of Organic Carbon Aerosol from Wildfires in the western United States. Atmos. Chem. Phys., 21, 11843–11856, https://doi.org/10.5194/acp-21-11843-2021, 2021.

A. M. Avery, M. W. Alton, M. R. Canagaratna, J. E. Krechmer, D. T. Sueper, N. Bhattacharyya, L. Hildebrandt Ruiz, W. H. Brune, and A. T. Lambe, Comparison of the Yield and Chemical Composition of Secondary Organic Aerosol Generated from the OH and Cl Oxidation of Decamethylcyclopentasiloxane, ACS Earth Space Chem., 7, 1, 218-229, 2023.

Additional references available at
https://sites.google.com/site/pamwiki/

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