Secondary Aerosol Formation during CalNex-LA: Real-time HR-AMS Measurements from a Photooxidation Reactor (PAM)


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Summary

- Artificial photochemical processing of LA-Basin plume
- More PAM enhancement at night than day, suggests short-lived SOA precursors
- Organic aerosol appears to decrease at very high OH

Potential Aerosol Mass (PAM) Reactor

Real-Time Photochemical Processing Device

Modified PAM Chamber from Kang et al., 2007; 2010
- Small (1 ft flow-through chamber)
- Short residence time ~4 min
- Aluminum shell (no loss of charged particles)
- UV light from mercury lamps (254 and 185 nm)
- High OH radical levels via O3 or O2 photolysis
- 10-1000 times tropospheric oxidant concentrations
  - O3 \( \rightarrow \) O + O3 (185 nm)
  - O3 + O3 \( \rightarrow \) O + O + O
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CalNex-LA Experimental Setup

- PAM reactor with open flow-through configuration (no inlet) to sample ambient air continuously
- PAM output was measured by an HR-ToF-AMS (DeCarlo et al., 2006), TSI SMPS, O3, SO2, and relative humidity monitors
- Measurements alternated between ambient and PAM-processed air with five minute time resolution
- Intensity of photochemical processing varied in steps by adjusting UV lights (which change OH and O3 conc.)

PAM Processing: Low Inorganic Period

- A 24 hr period from 20:00h May 29 – May 30 with high organic, low inorganic concentrations.
- Divided into two 8-hr periods: Day and Night
- Enhancement of organic and sulfate aerosol compared to aging
- Organic enhancement at night with moderate OH, mass decrease at highest OH

Changes to Size and Oxidation

- Significant size shift in SMPS data at high OH
- Contributes to mass loss at high OH due to AMS size cut ~50 nm
- Ratio of m/z 44 to total OA (f44) compared to m/z 43 to total OA (f43), Ng et al., 2010.
- PAM processing colored by Atm. Eqv. Age, f44 to f43 ratio shifts

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References


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