

Interactive comment on “Secondary organic aerosol formation exceeds primary particulate matter emissions for light-duty gasoline vehicles” by T. D. Gordon et al.

Anonymous Referee #2

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Overview

This manuscript presents new information about the SOA-forming potential of light-duty gasoline vehicles (LDGV). With dynamometer experiments, the authors characterize emissions of non-methane hydrocarbons and primary organic aerosol from 15 vehicles that cover a range of model years. SOA was formed by reaction in a smog chamber post-emission. The authors strived to make the chamber representative of ambient conditions, but were faced with practical challenges that led them to seed the chamber with ammonium sulfate add propene to control the VOC/NO_x ratio. The major findings are succinctly summarized by Reviewer 1. The manuscript is well-written and presents

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new information about SOA-forming potential of LGDV under laboratory conditions. I share the concerns noted by the other reviewer and recommend publication only after the concerns of Review 1 and the additional questions listed below are addressed.

Major comments

Page 23182 – The significance of the statement “There was no evidence of organic particle signal at m/z 28 (CO⁺)” is missing. Were other OA signals present? If so, which ones were used to generate the OA time series in figure 4C?

Page 23187 line 23, discussion of Figure 4C – “The SOA production increased linearly with OH exposure” but then dropped off around 6×10^6 molecules cm^{-3} . What is the significance of the deviation from linearity?

Page 23188 - What conclusions are drawn from blanks and what are the implications of the blank experiments? What is the variability across multiple blank experiments?

Page 23191 line 22 – The statement “Vehicle emissions are mainly composed of saturated species” is not supported by reference and contradicts the data in Figure 3 that shows unsaturated hydrocarbons (e.g. single-ring aromatics) are 20-26% of NMOG emissions.

Figure 5 – What does it mean if the effective SOA yield is greater than 100%? From section 3.3, it appears that this means that an impossible fraction of organic emissions must be converted to SOA to explain the chamber data.

Missing details

Page 23179 line 5, please list the names of “basic gases” that were measured.

Equation 1, what MW was used for NMOG and why?

Are data in Figure 5 blank subtracted?

Why are DPF experiments used as background in the study of LDGV?

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The equation used to calculate the effective SOA yields and mass closure should be included in the body of the main document, in section 3.3.

Suggestions to improve clarity

Page 23182 lines 7-8 "... the measured mass fraction of carbon in the gasoline was 0.85 kg-C kg-fuel-1 (Table S3)."

Page 23182, line 26: "... the measured loss of sulfate seed particles."

Page 23193, line 18 "the percentage of organic emissions. . ."

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 23173, 2013.

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