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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Time-resolved characterization of primary and secondary particle emissions of a modern gasoline passenger car" *by* P. Karjalainen et al.

Anonymous Referee #1

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As particulate matter emissions from diesel engines come under progressively better control, the focus will turn to emissions from gasoline engines. Gasoline-direct injection (GDI) engines are becoming increasingly common in the new vehicle fleet, and since they have many operational characteristics in common with diesels, they are a larger source of particulate matter emissions than traditional port injection gasoline engines.

This is an interesting and useful study of emissions from a GDI engine, including an estimate of the secondary organic aerosol which can form from the primary emissions through atmospheric photo-oxidation. The work appears generally sound but there are some issues of presentation and also some clarification is required.

The largest area of uncertainty relates to the measurements of secondary particle formation. These were made using a potential aerosol mass (PAM) chamber installed between primary and secondary dilution units and containing ozone concentrations at the exit of on average 6 ppm. These conditions are far more concentrated for both the exhaust pollutants and the oxidants than occur in the atmosphere and it is far from clear what the results for the secondary formation mean in an atmospheric context. Additionally, the secondary pollutants are created in an atmosphere containing the primary pollutants and it is not clear whether they should be determined by difference (i.e. subtracting the primary concentrations) or if this has already been done. The fact that there are some divergences between results obtained with the PAM chamber and batch chamber studies most probably conducted at more realistic dilutions is attributed to differences in emissions and in wall losses (page 33267, lines 14-16). The presence of different exhaust and oxidant concentrations in comparison to those batch chamber studies may well also be an important explanation which the authors do not discuss.

Most of the other points are relatively minor and including the following:

(a) Page 33259 – the fuel is defined but there is no mention of the sulphur content which is an important determinant of the particulate matter emissions. This should be clarified.

(b) Page 33260, line 26 – a density of 0.619 g dm-3 is described. However, it is not clear what this density relates to (is it the hydrocarbon particles?), but it seems likely to be in error by three orders of magnitude.

(c) Page 33263, line 15 should refer to 'ammonia' rather than 'ammonium'.

(d) Page 33265, line 27 – this refers to the temperature of the catalyst but there has been no earlier description of the position of the catalyst in the pollution control system or the function of the catalyst. Is this an oxidation catalyst?

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