

***Interactive comment on “Application of a Hygroscopicity Tandem Differential Mobility Analyzer for characterizing PM Emissions in exhaust plumes from an Aircraft Engine burning Conventional and Alternative fuels” by Max B. Trueblood et al.***

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Anonymous Referee #1

We thank the referee for a very thorough review of our manuscript.

The referee's comments on various topics were very valuable and we believe that ad-

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addressing these issues considerably improves the manuscript.

–reviewer’s comments (in italic typeset, blue font). –a point-by-point response (in regular typeset, black font)

RC#1 There are a large number of abbreviations in this manuscript. I would recommend to include a list of abbreviations at the end of the text. RESPONSE #1: We have inserted a list of abbreviations at the end of the manuscript.

RC#2 Page 3, line 12: In the text, the authors use the unit “L m<sup>-1</sup>” as the abbreviation of liter per minute. Since “m” is also used as the abbreviation for meter in many places in this manuscript, I would recommend to change the unit of flow rate to “L min<sup>-1</sup>”. RESPONSE #2: We have changed the units to “L min<sup>-1</sup>” in the manuscript.

RC#3 Page 7, line 9: The authors claim that RHO<sub>u</sub> and RHO<sub>o</sub> are assumed to be known, but they only provide the assumed value of RHO<sub>u</sub> based on a previously published study. What is the assumed value of RHO<sub>o</sub> used in this study? RESPONSE #3: These values are added in a table in the Supplemental Data.

RC#4 Equation (2): Unit of the numerator (3.3<sub>10</sub><sup>-5</sup>), which seems cm K, should be added in the equation, because if the diameters are in nm in Equation (1), then the numerator would be (3.3<sub>102</sub>) nm K. RESPONSE #4: We have made this correction.

. RC#5 Page 8, line 7: The authors indicate that osmotic coefficients can be related to the square root of the molality by a 6th order polynomial function with considerable accuracy. How accurate, 1%? I would recommend to present the formula and give an example to demonstrate its accuracy. RESPONSE #5: This has been added in the Supplemental Information. Both a table and formulas are presented.

RC#6 Page 8, lines 8: Also for the osmotic coefficients, the authors mention that “it is diameter dependent and must be taken into account,” but didn’t clarify how to take the diameter-dependence into account. RESPONSE #6: This is dealt with in Eq. (8) and in the Supplemental Information at the end.

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RC#7 Page 9, Table 1 and Figures 7-11: The diameter of dry particles is defined as “ $X_d$ ” in the text, but in those table and figures, it is presented as “ $X_d$ ”. Please be consistent. RESPONSE #7: That table has been deleted.

RC#8 Page 15, lines 26: The authors claim that “The sulfur in the fuel is oxidized to  $SO_2$ , which then undergoes rapid oxidation to  $SO_3$  and subsequently to sulfuric acid: :” I agree with the authors that all the fuel sulfur is oxidized to  $SO_2$ , but disagree that oxidization from  $SO_2$  to  $SO_3$  is rapid. In fact, it is very inefficient ( $\sim 1-5\%$ ), as the two cited references indicated. RESPONSE #8: We have deleted the word “rapid”.

RC#9 Page 16, line 8: Reference, Gysel et al. (2007), is not presented in the reference section. Please verify. RESPONSE #9: We have inserted this citation in the list of references.

RC#10 Page 16, line 14: For fuel sulfur content (FSC), the authors use the unit of  $\mu\text{g}$  of sulfur per g of fuel, but in Table 2, the authors also use the unit of ppm. Please be consistent. RESPONSE #10: We have corrected this, and use ppm throughout to be consistent.

RC#11 Page 16, line 14: I don’t understand the meaning of “old and modern cruise conditions”. RESPONSE #11: The text in the manuscript has been updated to refer to combustor inlet temperature conditions. The references to old and modern cruise conditions have been removed.

RC#12 Could the authors provide an estimate of experimental uncertainties of the determined GF and SMF results in Section 5? RESPONSE #12: We have removed the hygroscopic property SMF and replaced it with  $Kappa$  based on the recommendation of another reviewer. The experimental uncertainties in GF and  $Kappa$  are now provided in Section 5. We have included the following sentences in the revised manuscript: “The uncertainty in GF was 9% particles with diameter  $\sim 10$  nm, and 3% for the larger diameters (26 nm). The uncertainty in  $\kappa$  was 7% and 2% for particles with diameter  $\sim 10$  nm and  $\sim 26$  nm, respectively.”

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RC#13 Page 21, line 5: the referenced journal should be “Atmos. Environ.”. RESPONSE #13: We have corrected this in the manuscript.

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