Response to Reviewer #2

General comment:

The authors present an application of the recently developed DEMS methodology in the aerosol evaporation kinetics measurement. Evaporation of laboratory-generated single-component organic particles, including Glycerol, PEG4, PEG5, PEG6, and Dibutyl sebacate were measured and investigated across temperatures ranging from 295 to 343 K. The vapor pressures deduced from DEMS measurements are generally in good agreement with literature values, demonstrating that the DEMS is capable of characterizing aerosol evaporation kinetics. This manuscript is well-written and fits the scope of Atmospheric Measurement Techniques. The reviewer recommends accepting this manuscript after addressing the following minor comments.

We thank the reviewer for the positive feedback and those comments that have helped to improve our manuscript. We answer the comments point-by-point below:

Comment #1:

"DEMS is designed to conduct in-situ measurements of rapidly evolving aerosol systems" is slightly ambiguous here. The DEMS is indeed an advanced technique for probing the aerosol kinetic processes (e.g., evaporation and/or condensation), and this process should be within the classification region. However, it is not designed to handle rapidly evolving aerosols in the atmosphere.

Response:

Thanks for your suggestion. We have revised the sentence as follows: "DEMS is designed to conduct in-situ measurements of the kinetics of rapid aerosol processes happening inside its classification region, occurring at a timescale close to that of one EMS voltage scanning cycle".

Comment #2:

To better understand the dominating factor of the uncertainties of DEMS, I recommend the authors provide the uncertainty analysis in a more quantitative way, e.g., from the simulation perspective, such that the readers can directly compare uncertainties of the vapor pressure raised from various factors. Currently, only the uncertainty of diffusion coefficient is taken into account, and it would be better to demonstrate the uncertainties in numbers (e.g., put in a table). Other potential factors, including the assumption of constant Knudsen number, Kelvin effect, and particle residence time may also be considered for this estimation. Note as particles continue to shrink to a fairly small size, Brownian diffusion may also raise uncertainties, and this should be considered for future applications to nano-sized particles.

Response:

Thank you for your suggestions. Quantifying uncertainties is crucial for ensuring the robustness of our approach. In addition to diffusion coefficients, we have addressed uncertainties for several other factors in the current manuscript. For instance, the assumptions of constant Knudsen number and Kelvin effect have been examined through numerical simulations that did not rely on these assumptions. The agreement between the theoretically derived and numerically obtained evaporation profiles (Fig. 3 in the main text) supports the validity of these assumptions. Other factors, such as the temperature gradient, vapor concentration gradient, and the exact particle evaporation time/residence time inside the classification region, indeed require further validation. These will be addressed through computational fluid dynamics and heat transfer simulations of the flow and temperature fields in our future work. Thank you for your note on the importance of Brownian Diffusion when measuring small-sized nanoparticles. This is another significant factor. We have added the following text to the manuscript to clarify these points:

Pg. 19: "The DEMS uncertainty bars largely overlap with the literature values, indicating a good agreement between the values, and reinforcing the accuracy of the DEMS in measuring the flat surface vapor pressures of organic nanoparticles. It should be noted that the uncertainties for other factors, such as the temperature gradient, vapor concentration gradient, and the exact particle evaporation time/residence time inside the classification region, may require further in-depth quantification. These will be addressed through computational fluid dynamics and heat transfer simulations of the flow and temperature fields in our future work. Furthermore, the importance of Brownian Diffusion needs to be incorporated when applying the method to small-sized nanoparticles."

Comment #3:

Line #299: "values we found from" – values were found from?

Response:

Thank you for the note, and we have revised the text on line 299 as follows: "Glycerol vapor pressure literature values were found from the Chemical Engineering and Materials Research Information Center (CHERIC)".

Comment #4:

Line #323: "Fig. S4, Fig. S5: - Fig. S5, Fig. S6?

Response:

Thank you for the note. We have revised the text on line 323 as follows: "These tails were found in the measurements of glycerol and PEG4 at 303 K (Fig. S5, Fig. S6)."