Anonymous Referee #3, 14 May 2025

Danelli et al. present a study investigating the EC/OC ratio, particle size distribution, and MAC of carbonaceous aerosols produced from the combustion of various fuels using an atmospheric simulation chamber. The experimental setup is well designed, and the results provide meaningful insights into the optical properties of combustion-derived aerosols. This study aligns with the scope of ACP as a measurement report. I recommend it for publication, provided the following comments are addressed:

1. The current title may be misleading, as not all particles investigated are derived from diesel exhaust. I suggest revising the title to better reflect the scope of the study. For example:

   "Investigation of Optical Properties of Carbonaceous Aerosols from the Combustion of Different Fuels Using an Atmospheric Simulation Chamber."

   We thank the Reviewer for the suggestion. We have modified the Title in:
   "Measurement Report: Investigation of Optical Properties of Carbonaceous Aerosols from the Combustion of Different Fuels by an Atmospheric Simulation Chamber."

2. While the study focuses on aerosol optical properties, no health-related outcomes are presented. Therefore, I suggest removing or minimizing health-related discussions in the Introduction, as they may distract from the main focus.

   Thanks for the comment, we have reviewed the introduction as suggested.

3. For the MISG experiments, please clarify the rationale for selecting the specific "global equivalence ratio." Was this condition intended to replicate soot production mechanisms similar to those in diesel engines? Since the EC/OC ratio is highly sensitive to combustion stoichiometry, a justification for this choice is essential to contextualize comparisons with engine-derived emissions. Additionally, please ensure the reference "Vernocchi et al., 2022" is listed in the References, as it appears to be missing.

   We thank the Reviewer for the comment. The MISG was included in this study due to its ability to generate nearly pure EC particles. Inverted-flame burners such as the MISG are widely recognized as ideal soot sources, as they operate under controlled conditions and produce mature, EC-dominated soot. In our study, we do not consider the MISG settings to represent any specific type of atmospheric soot; rather, MISG was used as a reference source under operating conditions selected following Vernocchi et al. 2022 (now added to the References section).

   To clarify this point, we have added the following sentences to the manuscript:

   - Line 121: "*The MISG is an inverted-flame burner often considered an ideal soot source due to its capacity to generate almost pure EC particles (Stipe et al., 2005; Moallemi et al., 2019, and references therein).*"
   - Line 126: "*In this study, the MISG, considered a reference EC-dominated soot source, was fueled with propane at a fixed air-to-fuel ratio, following Vernocchi et al. (2022).*"

4. The measured particle size distributions are based on mobility diameters (SMPS). Did the authors consider the influence of particle morphology? For instance, the larger mobility diameters observed for soot generated by MISG are likely due to the aggregate structure typical of high-EC (soot-rich) particles. This morphology can significantly inflate the mobility diameter relative to the volume-equivalent diameter and should be discussed when interpreting the size data.

We thank the Reviewer for this observation. We agree that particle morphology can influence size measurements. To address this point, we have added the following sentence to the manuscript (line 280):

"In combustion processes where EC predominates, such as in the case of propane used in this study, the emitted particulate matter typically exhibits the characteristic fractal-like structure of soot, which may affect the electric mobility diameter measured by the SMPS, resulting in greater values of mobility diameters. In contrast, when the soot OC fraction increases, the particle size tends to decrease, and the morphology shifts toward more compact, rounded aggregates (Heuser et al., 2024, Leskinen et al., 2023)."

Heuser, J., Di Biagio, C., Yon, J., Cazaunau, M., Bergé, A., Pangui, E., Zanatta, M., Renzi, L., Marinoni, A., Inomata, S., Yu, C., Bernardoni, V., Chevaillier, S., Ferry, D., Laj, P., Maillé, M., Massabò, D., Mazzei, F., Noyalet, G., Tanimoto, H., Temime-Roussel, B., Vecchi, R., Vernocchi, V., Formenti, P., Picquet-Varrault, B., and Doussin, J.-F.: Spectral optical properties of soot: laboratory investigation of propane flame particles and their link to composition, EGUsphere [preprint], doi: 10.5194/egusphere-2024-2381, 2024.

Leskinen, J., Hartikainen, A., Väätäinen, S., Ihalainen, M., Virkkula, A., Mesceriakovas, A., Tiitta, P., Miettinen, M., Lamberg, H., Czech, H., Yli-Pirilä, P.: Photochemical Aging Induces Changes in the Effective Densities, Morphologies, and Optical Properties of Combustion Aerosol Particles. Environ. Sci. Technol. 57, 13, 5137–5148, 2023

5. Please include the standard deviation of the EC:TC ratio in the abstract.

   Thanks for the comment, we have added the standard deviation in the abstract.