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Discussions

Interactive comment on "Towards an understanding of surface effects: Testing of various materials in a small volume measurement chamber and its relevance for atmospheric trace gas analysis" by Ece Satar et al.

Anonymous Referee #1

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This paper described the testing of various materials in an aluminum chamber designed such that various materials can be inserted in the chamber and tested for adsorption effects. This paper is a follow-on from a previous paper that described the testing chamber and analytical challenges (10.5194/amt-2019-197). The paper is well-written and contains informative figures. For many of the materials tested, desorption of CO_2, CH_4, and CO were minimal, which is good news for the measurement community. However, it is not exactly clear how the results of these experiments relate to atmospheric trace gas analysis due to significant differences between this work and

how compressed gas standards are used in practice.

General comments:

You mention that you did not subtract the background, or blank (empty) run from the experiments. In figure 5, it would seem that the empty run shows much the same signals as the materials tested, which I suppose is why you state that only Duran showed significant difference. I think this needs further explanation related to the other Satar et al 2019 paper (10.5194/amt-2019-197). On page 12, you mention that you measured the "blank" or background at the beginning at at the end of the experiments, and the the "blank" shown in figure 6 is the mean. How for this impact the conclusions? Do you know if the background changed smoothly over time, or abruptly as a results of adding Dursan or DLC? Further, I think your can better explain why you chose the maximum deviation (page 7, line 9), given that making measurements at sub-ambient pressure introduces complications, as described in the other Satar et al 2019 paper.

How do these results compare with others studies (Leuenberger et al 2015; Schibig et al 2018) that suggest that a Langmuir isotherm can be used to model the physical adsorption? Your tests seem to show a much steeper increase at the lowest pressures. Is the abrupt increase at the lowest pressure related to desorption, or is it complicated by analysis at low pressure? I realize the analysis is discussed in the the first Satar et al 2019 paper, but I think some important aspects need to be repeated here.

Since it not common to use a cylinder of gas down to less than 10% of the fill pressure, what would these results say about that practice?

I am also concerned about how to interpret the results with respect to materials used by the scientific community. The inside of an aluminum cylinder, for example, does not typically look like the outside. Presumably the process of manufacturing a cylinder (using a ram rod) alters the surface roughness of the inside, and may deposit trace elements on the internal surface. While you tested the same aluminum alloy used for cylinders, the tested materials might not be representative of actual cylinders. Have

you tested pieces of material cut from aluminum or steel cylinders? Maybe it doesn't matter since the results don't show significant desorption, but this should at least be discussed.

Specific Comments

P1, L5: suggest: "For this study we used small-volume chambers designed to be used for adsorption studies".

P3, L30: suggest: "A mother cylinder was . . . ."

Figure 4: Minor point: I'm not sure of the significance of the box plots based on only 3 data points. I guess you are assuming normal distributions and assigning quartiles based on the standard deviation.