

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-883

Anonymous Referee #1

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Referee comment on "Enhanced soot particle ice nucleation ability induced by aggregate compaction and densification" by Kunfeng Gao et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-883-RC1>, 2021

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The manuscript presents a comprehensive laboratory investigation of IN properties of soot under cirrus conditions simulated in a continuous-flow diffusion chamber. Two types of commercial soot were analysed fresh and after mechanical agitation, which resulted in compaction of soot particles as revealed by electron microscopy. The resulting four kinds of soot material were further separated into four size classes each and investigated by N<sub>2</sub> and Ar sorption measurements regarding differences in their pore size distribution. Soot water interaction was precisely characterised by dynamic vapour sorption measurements. Differences in morphology, in particular mesopore abundance as a factor of compaction and particle size, and the resulting propensity for pore condensation freezing, convincingly explain observed differences in IN activity between the four kinds of soot material and their size classes.

The clear structure of the manuscript makes it easy to follow. There is little I can suggest in terms of further improvements, except perhaps a broader outlook on the implications following from these investigations. For example, what might be the effect of future changes in jet fuel composition, such as additions of biofuel or synthetic fuel, to the IN activity of the generated soot?

Technical issues

Line 22: consider replacing 'agitation degree' by 'degree of compaction'

Figure 1: What does 'xx #/cc' stand for?

Line 277: replace 'an' with 'a'.

Figure 5: Please say in the legend what the red circles in panels a and b are indicating.

Line 358: This sentence needs rephrasing. Perhaps in this way: 'However, the rest of the AF curves for small size (60 and 100 nm) are not significantly different for compacted and fresh FW200 or PR90 soot.'

Line 411: replace 'shown that' with 'shown by the fact that'

Line 459: do you mean 'still more competitive'?

Line 529: 'the' instead of 'THE'?

Line 632: 'too large' instead of 'too larger'?

Line 773: 'preliminary' or 'primary'?

Line 778: replace 'are in favoured for' by 'favour'

Lines 781-782: I do not understand the sentence starting with 'Some aero-engine soot particles...'