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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Insights into the role of soot aerosols in cirrus cloud formation" *by* B. Kärcher et al.

**Anonymous Referee #2**

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Review of "Insights into the role of soot aerosols in cirrus cloud formation"

In this manuscript, the authors studied the formation of internally mixed soot containing particles using a microphysical-chemical model. In addition they studied cirrus formation scenarios. These studied lead to 2 principle scenarios: high concentrations of original soot emissions could slightly increase the number of ice crystals; low concentrations of particles originating from coagulation of emitted soot with background aerosols could lead to a significant reduction in ice crystal number.

This study nicely quantifies the mixing state of soot particles produced from aircraft, and the evolution of the mixing state in a dispersing plume. Furthermore, the study highlights the conditions under which soot could modify ice crystal concentrations in



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the upper troposphere. The document also highlights areas for increased research efforts, which include field and laboratory studies. This manuscript should be a catalyst for future studies on the indirect effect of soot on cirrus.

Overall, I found the manuscript well written, and I highly recommend the manuscript for publication.

My only major comment is that I would prefer a shorter document. The authors may want to consider shortening the discussion on line-shaped contrails and contrail cirrus, since it is not the main focus of the manuscript. I also feel that Figure 10 and the discussion on this figure could be removed from the manuscript.

Minor comments:

Page 7851, line 14. Please add a reference to support the statement "Most of the organic emissions probably consist of condensable aldehydes."

Page 7853, line 28-29. "We assume constant BCambient volume fraction in background particles over the entire size range." I am not sure what this statement means. Please expand on this. What "constant BCambient volume fraction" was used?

What is the approximate size of the aircraft exhaust plume after 24 hours? For example what is the width of the plume?

Page 7866, line 10. "The particle type most closely resembling the original nonvolatile emissions is VN, which is dominated by OM and BC, but also contains significant amounts of SA." Does this amount of SA correspond to a submonolayer coating or multilayer coating of SA? It would be good to indicate the possible coating thickness, so the model results can easily be correlated to the laboratory freezing data.

Page 7871, line 13-14. "The most recent studies show little or modest ice nucleation activity of soot particles in the immersion mode." What laboratory studies are the authors referring to here? Please add references here to clarify.



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