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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Soot-PCF: Pore condensation and freezing framework for soot aggregates" *by* Claudia Marcolli et al.

**Anonymous Referee #2**

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In this study, authors describe the ice formation dynamics within the soot aggregates. They describe and parameterize the relationship between various thermodynamic variables that control the nucleation of ice and soot morphology. The paper is well written, the analysis is original in such that they extend the previously PCF based theory to soot aggregates, and the development of a parameterization to predict AF is unique. I have few minor comments, and after addressing them I recommend the paper for publication.

Abstract: This section is bit long. To improve the readability, I would suggest reduce the length of the abstract. Some of the sentences can be moved to the main text.

Section 8: Soot particles in the atmosphere undergo aging, and the morphology of soot aggregates changes rapidly. The co-emitted gases (in biomass burning kind of



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Discussion paper

event) condense and modify the physical and chemical properties. Can the theoretical framework (equation 9) be applied in such case? The related question is how one can model if some pores are partially filled with the sulfates and organics. This will change or at least alter the ice formation mechanism. Any thoughts on applying this framework in a transient environment where the soot properties are evolving in time? There is vast literature on soot ice nucleation onset and AF at temperature less than -38 degC. How this previous data compares with the Fig 6? I wonder if it is possible to plot the Fig 6 data in RH-T space (RH on y-axis and Temperature on x-axis) to compare against literature data. AF can be colored with the marker size or colorbar. Can this parameterization (equation 9) be modified to take into account the vertical velocity (the information typically needed to model the cirrus clouds)?

Line 749: Discussion on aerosol-lamina is not clear. Is this means some particles were outside the lamina and did not had a chance to induce nucleation of ice? Does this artifact also affect all other measurements?

Line 752: what are other examples of previous parameterizations?

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