

Interactive comment on “Use of the Single Particle Soot Photometer (SP2) as a pre-filter for ice nucleation measurements: Effect of particle mixing state and determination of SP2 conditions to fully vaporize refractory black carbon” by Gregory P. Schill et al.

Anonymous Referee #2

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This paper presents a characterisation of an SP2 instrument that is to be used as a pre-filter for ice nucleation experiments. It presents a series of careful experiments to examine the evaporation of rBC by the incandescence laser as a function of laser power and shows that even at low laser powers an ultrafine particle population is observed in the exhaust of the instrument. TEM analysis shows that this is due to nucleation and not fragmentation. The conclusion is that a laser power of 930 nW is required for complete vaporization. The effect of black carbon on the ice nucleation of a range of standard

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proxies was carried out and it is shown that only when black carbon is internally mixed with the proxy does its IN efficiency change. These conclusions therefore allow the effectiveness of black carbon particles as IN to be separated from other IN as long as the population is externally mixed. Where significant internal mixing has taken place then its use as a probe may be less unequivocal. This characterisation is important and is certainly worthy of publication in AMT. The paper concludes that the results bolster confidence in the method to separate the effects of rBC in IN experiments and cites wildfires as an important area. I would question whether the tone should be so optimistic since significant dust is often present in wildfires and the mixing of rBC and dust in the near field of fires is not well characterised. My interpretation of the results presented here is that this is a potential shortcoming that cannot easily be overlooked nor tackled when using ambient data. This should be included in the final discussion and methods to identify its influence identified. The paper is largely very well written in my view and the figures are clear and understandable. There are one or two places where the text could be made more readable and these are identified below. It might be worth commenting in the discussion on whether the nucleation arises from the organic matter evaporating and then re-nucleating as well as the core. Whilst this is not important in your experiment since the particles were nearly all composed of rBC but for particles with significant coating, such as biomass burning particles it could a much bigger effect. One might also expect significant condensational growth of the nucleated particles in these conditions. Given the conclusions are focused on the use of the instrument for investigating the IN effectiveness of biomass burning this is worth including. Page 3 line 36: This line seems to alternate between singular and plural (finesses/face) Page 4 lines 5-6: s in figure and S in text Page 4 line 25: The description of the positions is not clear. Is this the time delay from the first point the signal passes the reference threshold? If so, which detector? This needs to be clear. Page 4: line 28: depend(a)nt dependent Page 6 line 7: A lesson learned from bitter experience I suspect Page 7 line 4: “of at least At” Figure 3: caption state the laser power used Page 9 lines 24-27: I do not feel that “rBC containing contribution” in figure

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8 is well described at all. What is “the effect” on laser power? and what does the scale on the x axis of the figure represent? This needs clarification. Page 10 line 16 of (the) SP2 laser Page 10 line 26: particles

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