

The manuscript "Scanning supersaturation CPC applied as a nano-CCN counter for size-resolved analysis of the hygroscopicity and chemical composition of nanoparticles" by Wang et al. presents a novel way of using a water-CPC as nano-CCN counter for inferring composition of nano-particles. The manuscript fits well to the scope of the journal, the science is sound and it presents a contribution to the existing literature. Thus I recommend it to be published after the following revisions are made. The biggest flaws of the manuscript are that the introduction is too short, failing to acknowledge previous work on the topic, and that the instrument and measurement procedures are not described with enough detail.

Major comments:

In the introduction and figure 1, you should clearly distinguish between direct and indirect methods to measure chemical composition of nano-particles.

Your work is definitely not the first attempt to close the gap between ~1-10nm. The introduction and figure 1 should include previous work done to get indirect information of the composition, e.g. using CPC-batteries, HTDMAs, volatility-DMPS, pulse-height analysis etc. You do refer to these later in the text (with relevant articles cited), but there should be a chapter also in the introduction, so that the reader can put your work into right context.

There is also another scanning supersaturation CPC system (Airmodus A11 or its previous models), which is currently widely in use (see e.g. Vanhanen et al., 2011, Kulmala et al. 2012, Lehtipalo et al., 2014). This should be discussed in chapter 2.2., when you introduce the principle of scanning supersaturation CPC. You should take this into account also in chapter 3.3. & conclusions, where you propose using the same principle also with other working fluids (which is, in fact, already done).

Chapter 2.3 and figure 4 are poorly connected. The sub-figures in 4b are too small to read, and they do not help me in understanding the text, and what was done to the data. On the other hand, the text does not help me in understanding the figures although there is a reference to chapter 2.3. in the figure caption!

Some details of the measurement setup are given in beginning of chapter 3.1. (instead of 2.3., where I would logically search for it), but a lot of information are missing. What was the polarity (positive/negative) of the size selected particles used for calibrations? What was used as the carrier gas? These things matter for the results (activation of particles in a CPC) especially in the sizes near or below 3 nm (see e.g. Winkler et al., 2008; Kangasluoma et al. 2013).

Chapter 2.3.1. A 4th explanation of the broadening of the activation curves is that your sample is not clean (i.e. there is impurities coming from the tubing/neutralizer/sample which interfere with the results as the impurities have different activation properties than pure sample). This is a big issue in sizes below 3 nm (see Kangasluoma et al., 2013). Did you measure the composition of your sample (with a mass spectrometer)? As you do not describe the setup in enough detail, I cannot evaluate if this is an issue, but impurities could easily explain why you observe a bi-modal distribution with the WO_x (currently no explanation is given in chapter 3.1).

What is the difference between solubility and solvoscopicity in this context? (There is a lot of references stating that particles soluble to the working fluid are activating in a CPC easier than insoluble ones). Can you compare the information you get from your systems, to the information from a HTDMA? You could discuss these issues in the conclusions and outlook chapter, which is currently quite restricted.

Minor comments:

Abstract: I think the very first sentence should read: *Knowledge* on the chemical composition is essential....

Introduction, row 23: the sentence *Chemical composition... is the key to understand...* is very vague. Please be more specific. Why is it a key?

Refer to Hering et al. (2005) when discussing water-CPCs in chapter 2.1

What is the model of your CPC? Include this information in chapter 2.2. A schematic picture of the whole nano-CCN instrument would also be helpful.

Figure 1 seems to be an adaptation of Kulmala et al. 2012 (Figure 1). Maybe there should be reference?

In chapter 2.2 you discuss different ways of scanning supersaturation. You should clearly mention which method was used in this study and the stabilization time of your system.

Chapter 3.1. Wimmer et al. 2013 is surely not a correct reference for the WO_x generator.

References:

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