

## ***Interactive comment on “A method for the direct measurement of surface tension of atmospherically relevant aerosol particles using atomic force microscopy” by A. D. Hritz et al.***

**Anonymous Referee #2**

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### **General comments**

The manuscript entitled: "A method for the direct measurement of surface tension of atmospherically relevant aerosol particles using atomic force microscopy" describes how to use a micro-Wilhelmy method to measure the surface tension of collected aerosol liquid in an atomic force microscope. While the manuscript is generally well-written, clear, very concise, and contains no major errors that I can tell, I wonder if it is, indeed, appropriate for publication in ACP.

From ACP's website ([http://www.atmospheric-chemistry-and-physics.net/about/aims\\_and\\_scope.html](http://www.atmospheric-chemistry-and-physics.net/about/aims_and_scope.html)), "*The journal scope is focused on studies with general implications for atmospheric science rather than investigations that are*

C1

*primarily of local or technical interest.*" While there are some general implications from this study, namely, that it presents a new way to measure aerosol liquid surface tension in a direct way that uses much less sample liquid than traditional bulk methods require, the focus of this manuscript seems to be on the technical method development. The more general application of this method was to one aerosol system, oxidized alpha-pinene SOA, under dry and moderately wet conditions. The analysis was extremely short and contained no other supporting information or measurements other than a comparison to a couple prior studies in the literature that don't actually match these results or methods well at all. For better "general implications for atmospheric science," the results section needs to be developed much more extensively.

Perhaps other journals to consider submitting to would be Atmospheric Measurement Techniques or Aerosol Science & Technology. AMT's aims and scopes include "*the development, intercomparison, and validation of measurement instruments and techniques of data processing and information retrieval for gases, aerosols, and clouds.*" AST's aims and scopes include "*instrumentation for the measurement of aerosol physical, optical, chemical and biological properties.*" I am sure there are other appropriate journals available as well.

### **Specific comments**

One major consideration the authors might also make is changing the title. The "direct measurement of ... aerosol particles" implies that the method is measuring surface tension on an individual aerosol particle; but this is not true. In reality, lots of aerosol particles are collected on a plate until there is a thin film of liquid covering the plate. In essence, this is still a *bulk* technique for measuring surface tension, just that this *bulk* is much, much smaller than traditional bulk methods (e.g. the traditional Wilhelmy plate method).

C2

pg 2 - line 11 : Are the results presented in this manuscript really "preliminary"? What will it take to make them final? Only final results (i.e. calibrated measurements from working instruments) should be published.

2 - 28 : Because this is a methods paper, it would be helpful to include equations and define each term and give the implications of each term of the equation. These include the Kelvin equation, Kohler equation (pg 3, line 6) and Raoult's Law (pg 3, line 6).

3 - 1 : What do you mean by "tabulated values"? Also, the literature review on surface tension measurements should be expanded - certainly there are more than two papers that talk about surface tension values with regards to nucleation?

3 - 3 : Is "shortly after nucleation" referring to a time issue or a particle size issue?

3 - 12 : What does "good" mean? What basis do you have for making the "good initial assumption" claim? This phrase is confusing, especially given the next sentence which says the surface tension is reduced by 10-15%.

4 - 6, 7 : Define "clean" air. What filters/scrubbers do you use? Is the air from a cylinder or compressed air line?

4 - 25-26 : This is the same basic sentence as pg 5, lines 4-5.

5 - 20 : To be clear, are you paraphrasing this method in the next few paragraphs? You should make it clear that the reader does or does not need to read the Yazdanpanah et al., 2008 paper.

5 - 29 : Is there a citation for equation 1?

6 - 3 : Is there an image that can be used to demonstrate the contact angle? Perhaps this can be included in a supplemental section.

6 - 10 : Explain better what capillary length means in the context of this measurement technique. Perhaps include an equation. This explanation is important to justify use of equation 2 as the basis for the technique.

C3

6 - 23 : I do not understand this calibration method. It sounds like you are pushing the needle into a hard surface and deflecting the needle. But it must be the case that the needle actually stays rigid and the deflection comes where the needle is connected to something else that measures force. Perhaps a figure describing this process with some actual images would be helpful. Also, if what I have described is how the calibration is done, then how do you relate deflection to force?

7 - 3 : What is a "thermal tune" and how exactly is it done?

7 - 15 : There is no mention of a "check standard" until later, which can be confusing when first looking at Figure 3. Also, where is the hard, steel surface used for calibration?

8 - 13-14 : What modifications? Explain in much greater detail what you mean by this sentence.

8 - 32 : Use of "particles at activation" implies measurement of individual small droplets - this is not true with these current methods. Can these "modification" (list them) actually get to measuring surface tension of individual droplets?

Table 1 : The term "reasonably close" is subjective and should be avoided. What temperature were your measurements taken at? Did you only take two measurements per solution? I think measurements should usually be done at least three times and then averaged. For these compounds, are there any temperature-dependent models of surface tension that you could use to better compare to your measurements at whatever temperature your measurements were taken at?

Table 3 : Which measurements are approximated versus measured? I can make a guess, but this should be much clearer in the table. In the caption, the last two sentences look like analysis, which should go in the body of the manuscript rather than in the caption. Where does the surface tension value of 27.5 come from? I can't find it on Table 2 anywhere. Also, Table 3 should have uncertainties next to each surface

C4

tension value.

### **Technical corrections**

A careful proofread of the entire manuscript should be done – there are several places where no space exists between words and several places where multiple spaces exist between words.

pg 2 - line 17 : Do not need this line; this information is in the citation.

2 - 30 : What is "this type"? Be more clear and specific.

3 - 23 : I am not sure ACP's convention, but should references be moved to the end of the sentence? This isn't the only sentence in the manuscript written this way, but this one first caught my attention as one where the reference could be moved to the end without sacrificing any meaning.

6 - 26-27 : This is an unnecessary detail.

7 - 22 : Fix "a an average"

8 - 10 : What is "This"?

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