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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A review of experimental techniques for aerosol hygroscopicity studies" *by* Mingjin Tang et al.

Anonymous Referee #1

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The work is important and of relevance to the readership. The authors present a review of hygroscopicity measurements as it pertains to the atmosphere and also orthogonal scientific fields (surface science, heterogeneous catalysis, geochemistry/astrochemistry, pharmaceutical and food science, etc). Thus the publication will be of interest to the ACP readership and other fields. The authors have done a good job to describe "non-conventional atmospheric" hygroscopicity measurements. That is they provide an overview of comprehensive laboratory techniques that due to time or spatial resolution is not necessarily applied to field studies. For instance, the spectroscopy section is quite thorough and provides information on the numerous spectroscopy techniques that have been applied in controlled laboratory settings. The review is useful in that it provides a current overview of the current state of technology for hygroscop-

icity. However, the paper does not include a review of the theoretical hygroscopicity equations (although, I do not think that this is the purpose of the manuscript). Furthermore, I was quite disappointed to find that CCN and IN techniques were not discussed at all and perhaps this omission should be reflected in the title. E.g. " A review of experimental techniques for unsaturated aerosol hygroscopicity studies"

Regardless of this disappointment, I highly recommend the work for publication in ACP. The work will be cited heavily in the future. The following are a few concepts and ideas that may strengthen and or clarify ideas in the manuscript. I sincerely encourage the authors to consider addressing these comments before eventual publication.

Comments.

1. The fluorescence spectroscopy section seems tangential to the hygroscopicity discussion. Much of this sections suggest that EDB is the actual technique and then fluorescence is used to measures the particle properties.

2. Time resolution of hygroscopicity measurements should also be discussed as a recommendation to improve measurements. The DASH-SP and HFIMS are the only fast resolution hygroscopicity measurements techniques currently used. Recent work by Wang et al (HFIM) should also be discussed.

3. The authors may consider discussing how advances in orthogonal fields may be of future importance to atmospheric measurements. For example, although not currently relevant to aerosol, the production of highly sensitive humidity sensors should be considered (e.g., Liang et al, 2018). The Dash-P and HFIMS, use faster sizing instrumentation however faster RH technology may also advance studies.

Minor Corrections

L83, aqueous particle becomes supersaturated?

L85. efflorescence is also kinetically controlled? How? Not clear how this statement is made.

L70 – Remove or define “and etc”

L81 – spelling “dehumification”

L95 - , insert word - leading to the formation OF two coexisting liquid”

L95 – change to : in one particle”

L120 – Remove “in specific,”

L189 – Change recently to recent

L385 – Change isotherm to isothermal

L1480 – “aerosol size is measured as” to “aerosol size is measured AT”

Additional References to consider

Wang, Yang, et al. "Retrieval of High Time Resolution Growth Factor Probability Density Function from a Humidity-controlled Fast Integrated Mobility Spectrometer." Aerosol Science and Technology just-accepted (2019): 1-18.

Liang, Jun-Ge, et al. "Thickness effects of aerosol deposited hygroscopic films on ultra-sensitive humidity sensors." Sensors and Actuators B: Chemical 265 (2018): 632-643.

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