

Interactive comment on “Sulfuric acid-amine nucleation in urban Beijing” by Runlong Cai et al.

Anonymous Referee #1

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Cai et al. present observations of sulfuric acid and amine nucleation in Beijing, a polluted city, and determine how coagulation sink plays a role in 1.4 nm nucleation rate vs sulfuric acid concentrations. They used a suite of instruments to measure sulfuric acid, its clusters, and particle size distributions. They model nucleation based on previous acid-base chemical reaction models where the limiting step is the formation of the aminated monomer. The manuscript provides good level of detail to justify their assumptions and analysis and is easy to read. This paper should be published in this journal once they address the minor comments below

Abstract: The whole manuscript is written quite clearly except for the last two sentences of the abstract. Rewrite them so they are less colloquial and more to the point.

Page 6 line 174: Detection efficiency of the larger sulfuric acid clusters definitely lower. The authors mention that detection efficiency decreases with higher masses. Do they

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mean transmission efficiency through the mass filter? If so, did the authors correct for this as shown in (Heinritzi et al., 2020; Zhao et al., 2010)? Also, the authors mention that the CIMS were calibrated for sulfuric acid concentration but how did they determine concentrations of the larger clusters? These cannot be calibrated so they must have made assumptions to calculate their concentrations from mass spec signals.

Page 7 after sentence 195. Add a sentence providing a probable reason for why simulate particle formation rates from Chen et al. and Jen et al. are lower than measured in this study.

Page 7, line 200: Despite the fact that the diurnal trends of particle formation rates do not match the concentration profiles of all observed oxidized organics, is it still possible that these organics play a role in the observed NPF despite high CS? Feels like organics encompass thousands of types of molecules and this paragraph is too dismissive of a potential role of organics in NPF.

Page 9 line 275. “It characterizes the ratio of 275 the condensational growth rate of a molecule or cluster to its loss rate.” It is too vague. Can the authors change it to horizontal coordinate?

Page 10 and Line 305 in the conclusion. “Comparing the measured particle formation rate and cluster concentrations with those simulated using a kinetic model, we demonstrated these new findings.” Could the authors be more specific about their new findings?

Works cited in this review: Heinritzi, M., Dada, L., Simon, M., Stolzenburg, D., Wagner, A. C., Fischer, L., Ahonen, L. R., Amanatidis, S., Baalbaki, R., Baccarini, A., Bauer, P. S., Baumgartner, B., Bianchi, F., Brilke, S., Chen, D., Chiu, R., Dias, A., Dommen, J., Duplissy, J., Finkenzeller, H., Frege, C., Fuchs, C., Garmash, O., Gordon, H., Granzin, M., El Haddad, I., He, X., Helm, J., Hofbauer, V., Hoyle, C. R., Kangasluoma, J., Keber, T., Kim, C., Kürten, A., Lamkaddam, H., Laurila, T. M., Lampilahti, J., Lee, C. P., Lehtipalo, K., Leiminger, M., Mai, H., Makhmutov, V., Manninen, H. E., Marten, R., Mathot,

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S., Mauldin, R. L., Mentler, B., Molteni, U., Müller, T., Nie, W., Nieminen, T., Onnela, A., Partoll, E., Passananti, M., Petäjä, T., Pfeifer, J., Pospisilova, V., Quéléver, L. L. J., Rissanen, M. P., Rose, C., Schobesberger, S., Scholz, W., Scholze, K., Sipilä, M., Steiner, G., Stozhkov, Y., Tauber, C., Tham, Y. J., Vazquez-Pufleau, M., Virtanen, A., Vogel, A. L., Volkamer, R., Wagner, R., Wang, M., Weitz, L., Wimmer, D., Xiao, M., Yan, C., Ye, P., Zha, Q., Zhou, X., Amorim, A., Baltensperger, U., Hansel, A., Kulmala, M., Tomé, A., Winkler, P. M., Worsnop, D. R., Donahue, N. M., Kirkby, J. and Curtius, J.: Molecular understanding of the suppression of new-particle formation by isoprene, *Atmospheric Chem. Phys.*, 20(20), 11809–11821, doi:<https://doi.org/10.5194/acp-20-11809-2020>, 2020. Zhao, J., Eisele, F. L., Titcombe, M., Kuang, C. and McMurry, P. H.: Chemical ionization mass spectrometric measurements of atmospheric neutral clusters using the cluster-CIMS, *J Geophys Res*, 115, D08205, doi:10.1029/2009jd012606, 2010.

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