

Interactive comment on “Nanoparticle Growth by Particle Phase Chemistry” by Michael J. Apsokardu and Murray V. Johnston

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The authors thank the referee for helpful comments to strengthen and clarify the manuscript. Our responses are provided below.

1. The referee would like clarification on our motivation for the selection of dimerization rate constants used in our calculations.

Author response: Our calculations used dimerization rate constants in the range 10^{-3} to 10^{-1} $M^{-1}s^{-1}$ with most calculations at 10^{-2} $M^{-1}s^{-1}$. As stated in the original manuscript, 10^{-2} $M^{-1}s^{-1}$ happens to be the reported value for dimerization of glyoxal. The reference cited by the referee (Ziemann, P. J. and Atkinson, R., Chem. Soc. Rev., 41, 6582–6605, 2012) reviews kinetic and thermodynamic data for several types

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of accretion reactions. Reactions relevant to growth of biogenic SOA are the reaction of a hydroperoxide with a carbonyl to give a peroxyhemiacetal, and the reaction of a peroxyacid with a carbonyl to form an acyl peroxyhemiacetal. In both cases, rate constants are reported to be in the 10^{-4} to 10^{-2} M⁻¹s⁻¹ range. Reactions such as aldol condensation of carbonyls and ester formation from an acid and alcohol are unlikely to be atmospherically relevant based on both kinetics (Casale, M.T., et al., *Atmos. Environ.*, 41, 6212–6224, 2007) and thermodynamics (DePalma, J.W. et al., *Phys. Chem. Chem. Phys.*, 15, 6935-6944, 2013). In the revised manuscript, we will add the Zie-mann and Atkinson reference and expand our discussion of the relevance of the rate constants we used for these calculations.

2. The referee suggests that the authors review a recent publication that focuses on gas-phase dimer formation (Mohr, C. et al. *Geophys. Res. Lett.*, 44, 2958-2966, 2017) for possible relevance to the manuscript.

Author response: The authors acknowledge the importance of Mohr et. al., 2017 for understanding biogenic SOA formation and growth. Dimer formation in the gas phase is relevant to our work since it provides a mechanism for producing nonvolatile organic compounds (NVOC) that can subsequently condense onto particles. Because we did not model NVOC formation in our work, but simply used a relevant gas phase mixing ratio (0.4 pptv), we have not referenced the Mohr paper. However, we expect this paper will be widely read and cited by the scientific community.

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