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Evidence for the role of organics in aerosol particle formation under atmospheric conditions

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New particle formation in the atmosphere is an important parameter in governing the radiative forcing of atmospheric aerosols. However, detailed nucleation mechanisms remain still ambiguous, as laboratory data have so far not been successful in explaining atmospheric nucleation. We investigated the formation of new particles in a smog chamber simulating the photochemical formation of H2SO4 and organic condensable species. Nucleation occurs at H2SO4 concentrations similar to the ones found in the ambient atmosphere during nucleation events. The measured particle formation rates are proportional to the product of the concentrations of H2SO4 and an organic molecule. This suggests that only one H2SO4 molecule and one organic molecule are involved in the rate limiting step of the observed nucleation process. Parameterizing this process in a global aerosol model results in substantially better agreement with ambient observations compared to control runs.

Reference: Axel Metzger, Bart Verheggen, Josef Dommen, Jonathan Duplissy, Andre S. H. Prevot, Ernest Weingartner, Ilona Riipinen, Markku Kulmala, Dominick V. Spracklen, Kenneth S. Carslaw, and Urs Baltensperger, Evidence for the role of organics in aerosol particle formation under atmospheric conditions, Proc. Natl. Acad. Sci. USA, 107 (2010), www.pnas.org/cgi/doi/10.1073/pnas.0911330107.