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## Homogeneous vs. heterogeneous nucleation in water-dicarboxylic acid systems

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**Abstract.** Binary heterogeneous nucleation of water-succinic/glutaric/malonic/adipic acid on nanometer-sized particles is investigated within the frame of classical heterogeneous nucleation theory. Homogeneous nucleation is also included for comparison. It is found that the nucleation probabilities depend on the contact angle and on the size of the seed particles. New thermodynamical properties, such as saturation vapor pressure, density and surface tension for all the dicarboxylic acid aqueous solutions are included in the calculations. While the new surface tension and density formulations do not bring any significant difference in the computed nucleation rate for homogeneous nucleation for succinic and glutaric acids, the use of the newly derived equations for the vapor pressure decrease the acid concentrations in gas phase by 3 orders of magnitude. According to our calculations, the binary heterogeneous nucleation of succinic acid-water and glutaric acid-water – although it requires a 3–4 orders of magnitude lower vapor concentrations than the homogeneous nucleation – cannot take place under atmospheric conditions. On the other hand binary homogeneous nucleation of adipic acid-water systems might be possible under conditions occurring in upper boundary layer. However, a more detailed characterization of the interaction between the surface and the molecules of the nucleating vapor should be considered in the future.

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