

Air Pollution

ENV-409

Multiphase equilibria

From Seinfeld and Pandis, 2006.

The total (gas plus aerosol) ammonia and nitric acid mixing ratios in an urban area are 10 ppb and 15 ppb, respectively. There is little sulfate in the area (i.e., neglect).

- a Assuming a relative humidity equal to 30%, calculate the equilibrium aerosol ammonium nitrate concentration in $\mu\text{g m}^{-3}$ as a function of temperature (from 0 to 35°C).
- b For a temperature equal to 25°C calculate the equilibrium aerosol ammonium nitrate concentration as a function of the relative humidity. (Calculate at 70 and 85% RH.)
- c For a temperature equal to 15°C and relative humidity equal to 30%, calculate the equilibrium aerosol ammonium nitrate concentration in $\mu\text{g m}^{-3}$ for an ammonia mixing ratio in the range of 0–20 ppb. Is the relationship between the aerosol ammonium nitrate concentration and the ammonia concentration linear? Why?
- d If the aerosol ammonium nitrate concentration is measured to be 2 $\mu\text{g m}^{-3}$ at 15°C and 30% RH, can you calculate the corresponding equilibrium concentrations of ammonia and nitric acid in the gas phase? Why?
- e Using the results above, discuss the factors that favor the formation of aerosol ammonium nitrate.