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Cooperativity between Volatilization of NH_3, Evaporation of Water and Crystallization of Na_2SO_4 in Internally Mixed Sodium Succinate/Ammonium Sulfate Aerosols

Pan Wang, Shu-Feng Pang, and Yun-Hong Zhang
School of Chemistry and Chemical Engineering, Beijing Institute of Technology, Beijing, China(yhz@bit.edu.cn)

Gas-to-particle partitioning is one of the most important physicochemical process in atmospheric aerosols. The chemical reaction in the internally mixed organic/inorganic aerosols attracts much attention on the volatility and hygroscopicity. In this study, FTIR spectra evolution with time were observed by FTIR-ATR technique at constant relative humidity for the internally mixed sodium succinate/ammonium sulfate aerosols with molar ratio of 1:1. The results showed that sodium succinate and ammonium sulfate in the mixed aerosols could react to form succinate acid and sodium sulfate accompanying NH_3 volatile as followings:

$NaOOCCH_2CH_2COONa$ (aq) + $(NH_4)_2SO_4$ (aq) → $HOOCCH_2CH_2COOH$ (aq) + Na_2SO_4 (aq or crystal) + NH_3 (g)

The volatilization of NH_3 speeded up the evaporation of water, and indirectly accelerated the crystallization of Na_2SO_4 in the mixed aerosols, which synergistically accelerated release of NH_3. The complex reaction between dicarboxylic salt and $(NH_4)_2SO_4$ could help us to understand the cooperativity between the gas-to-particle equilibrium, phase transition, atmospheric composition and volatility, which could reveal the formation mechanism of the secondary organic aerosols.