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A study of the phase transition behavior of internally mixed ammonium sulfate - malonic acid aerosols

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Abstract. This is a study into the phase transitions of aerosol composed of the ternary system ammonium sulfate (AS) - malonic acid (MA) - water using infrared extinction spectroscopy. Twelve compositions were studied in both deliquescence and efflorescence mode experiments. The presence of a MA fraction, by dry mass, (f_{MA}) of 0.1 in an AS aerosol altered the relative humidity at which the phase transitions occur in an atmospherically significant manner. For compositions with $0.25 < f_{MA} < 0.90$, no distinct "deliquescence" was observed, contrary to the observed behavior in the binary systems. The crystallization of both the MA and AS components is suppressed by the presence of the other component in the aerosol. At $f_{MA}=0.9$, the crystallization relative humidity of MA was lowered from $RH=6\%$ to less than 1%. Similarly, at $f_{MA}=0.4$, the AS component did not crystallize. The atmospheric implications of the results are discussed.

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