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The dissociation of ammonium nitrate was investigated under laboratory conditions using a tandem differential mobility analyzer/scanning mobility particle sizer technique. Changes to aerosol size and mass were recorded before and after transportation through a temperature controlled, 2-meter laminar flow reactor. The resultant changes to particle size and mass were then used to determine the dissociation rate, whilst ammonia gas concentrations were also measured simultaniously, on-line.

Four temperature settings were chosen as representative of typical indoor temperatures, whilst three aerosol sizes investigated typifying those of outdoor ammonium nitrate. Flow rates were also altered to allow for different residence times within the reactor, which can then be used as a proxy for outdoor ammonium nitrate penetrating indoors (Fischer et al., 2003, Lunden et al., 2003).

Results show dissociation rates are strongly linked to temperature, as suggested by previous literature, with increasing temperature rapidly increasing rates of dissociation of ammonium nitrate (Dassios and Pandis, 1998). Residence time within the reactor also changes the degree of dissociation, with the increased time spent in the reactor accelerating the rate of dissociation through all temperature regimes. A corresponding increase in ammonia was also observed with accelerated increase in concentration correlating to increasing tempertaure.

These results have important implications for measurements where ammonium nitrate volatility provides an unwated positive artifact, possible new particle formation indoors, as well as for preservation research.

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References

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