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## Phase-transition of ambient PM<sub>2.5</sub> samples collected in the Po Valley: deliquescence and crystallization relative humidity measured in Aerosol Exposure Chamber

The aerosol hydration level affects the aerosol optical properties [1] and its corrosion capability on metallic surfaces [2]. In this respect, corrosion prevention in Data Center basing on aerosol properties could produce energy-saving benefits.

In this work, PM<sub>2.5</sub> samples collected in the Po Valley were subject to an innovative analysis method to characterize mutual deliquescence and crystallization RH (MDRH and MCRH). PM<sub>2.5</sub> conductivity was measured while varying RH in a new Aerosol Exposure Chamber (AEC). Constant temperature was kept in AEC and RH steps were of 1%. PM<sub>2.5</sub> samples were also chemically analysed by ionic chromatography (IC).

Seasonal variability of MDRH and MCRH was identified. In particular, MDRH in wintertime was  $60.1 \pm 1.1\%$  while in summer was  $71.8 \pm 0.9\%$ . MCRH was recognized at  $46.9 \pm 1.1\%$  in winter and at  $64.9 \pm 1.1\%$  in summer. Thus, hysteresis amplitudes between the two seasons were significantly different and they were quantified to be  $13.2 \pm 1.1\%$  in winter and  $7.3 \pm 0.7\%$  in summer. IC analysis showed that in Milan sulphate compounds dominate the PM<sub>2.5</sub> ionic fraction in summer ( $17.8 \pm 1.5\%$ ) while nitrates compounds dominate in winter ( $21.5 \pm 3.6\%$ ). These data allow us to understand the seasonal behaviour of MDRH and MCRH as  $(\text{NH}_4)_2\text{SO}_4$  and  $\text{NH}_4\text{NO}_3$  are responsible of increasing and decreasing of critical RH, respectively.

Considering the RH values in Milan during 2006-2013, the measured MDRH and MCRH allowed to estimate that the aerosol is hydrated for 33% of time in winter and summer seasons. Moreover, an innovative application of these data for Data Center cooling application will be discussed: briefly the knowledge of MDRH and MCRH allowed to save in one year 81% of energy with a CO<sub>2</sub> emission-saving of 80 kt in the newly constructed Eni Green Data Center ([http://www.eni.com/green-data-center/it\\_IT/pages/home.shtml](http://www.eni.com/green-data-center/it_IT/pages/home.shtml)) [2].

[1] Martin ST(2000), Chem Rev 100:3403–3454

[2] Ferrero L et al.(2013), Environ Sci Technol. 47:3856-64

### Working group IAS (WG1, WG2, WG3) o sessione speciale (SPR)

WG3

### Tipo di presentazione (orale o poster)

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