Comparison of volatility, hygroscopicity and oxidation state of submicron aerosols over the Pearl River Delta region in China

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Methods

VH-TDMA

Hygroscopicity → ACSM → Chemical composition

Volatility → AE33 → Mass concentration of BC

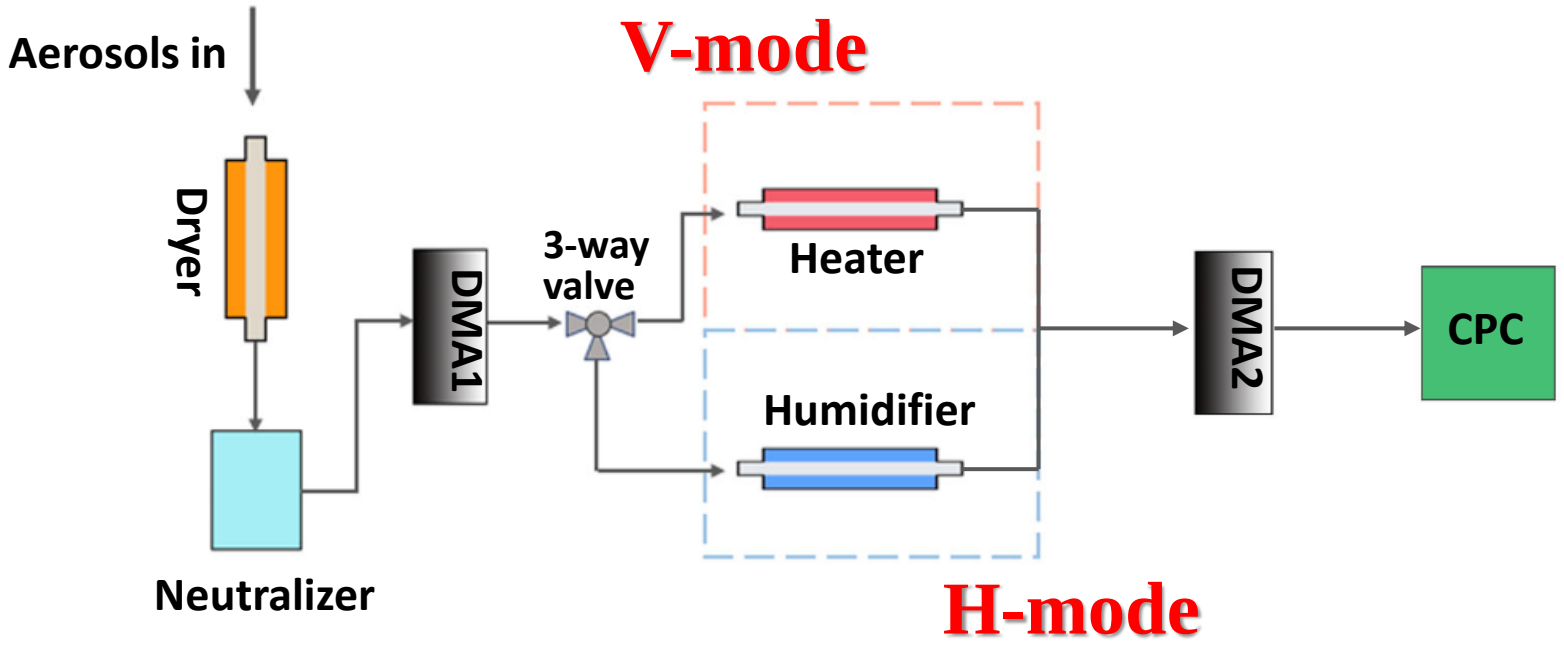
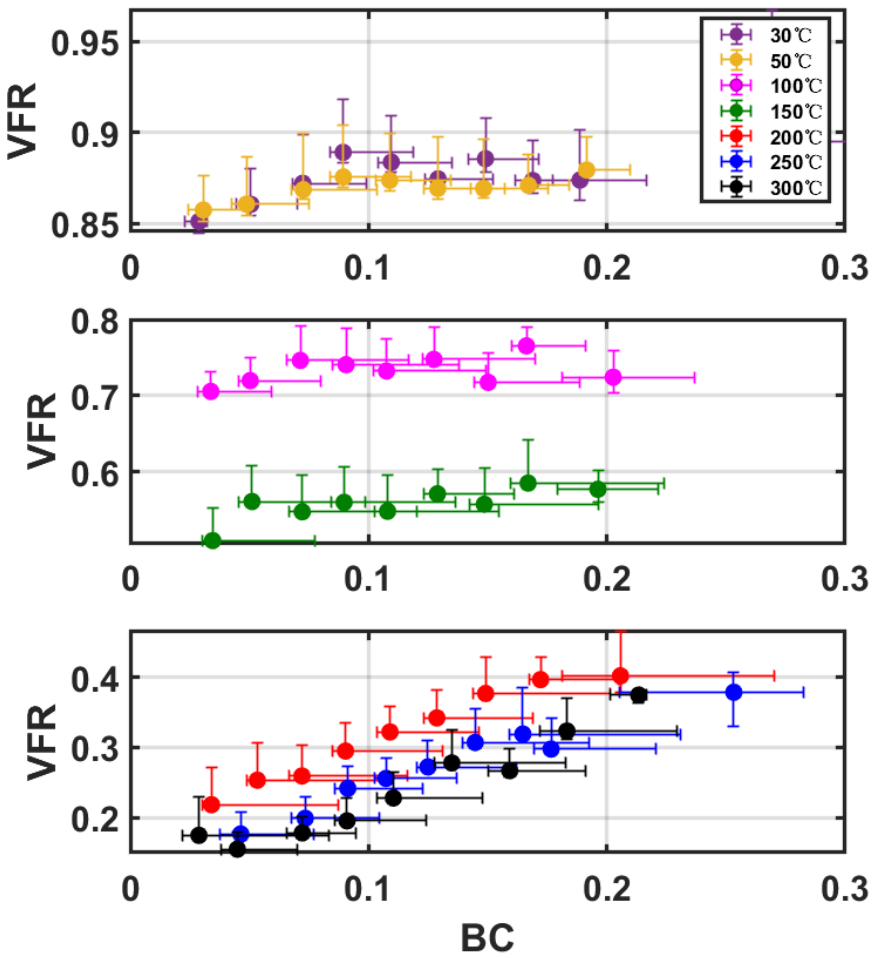


Figure 1. A schematic of the VH-TDMA instrument system.

Results and discussion



◆ **VFR:** volume fraction remaining

$$VFR = \frac{D_p^3(T)}{D_p^3(T_{room})}$$

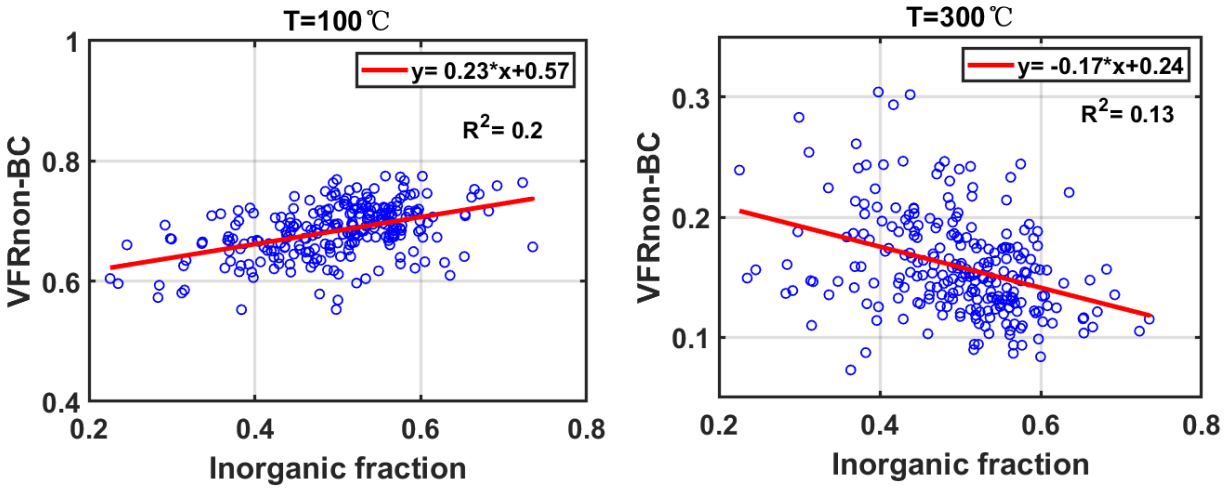
$\boldsymbol{D_p(T_{room})}$:the size of the particles at dry conditions (RH<10%) at room temperature

$\boldsymbol{D_p(T)}$: diameter of a particle after heating to a certain temperature

➢ BC mass fraction correlated well ($R^2 \approx 0.5$) with the VFR above 200℃, but could not explain the non-volatile residual alone.

Figure 2. Relationship between BC fraction and the volume fraction remaining (VFR) of the particles (size 145nm) at the temperatures of 100℃、150℃、200℃、250、300℃, respectively.

Results and discussion



- Inorganic compounds evaporated at higher temperatures, and could not explain the refractory at higher temperatures

Figure 3. Correlation between inorganic fraction and the $VFR_{\mathrm{non}BC}$ of 145nm particles at different temperatures.

$$BCF = \frac{M_{BC}}{M_{tot}}$$

$$VFR_{\mathrm{non}BC}(T) = VFR(T) - BCF \cdot \rho_{BC}$$

BCF: BC fraction in the aerosol mass

$\boldsymbol{M_{BC}}$: mass concentration of BC

$\boldsymbol{M_{tot}}$: total mass concentration of aerosols

$\boldsymbol{VFR(T)}$:volume fraction remaining at (T)

$\boldsymbol{VFR_{nonBC}(T)}$: volume fraction remaining at (T) without the effect of BC

$\boldsymbol{\rho_{BC}}$: density of BC (1.8 g/cm^3)

Results and discussion

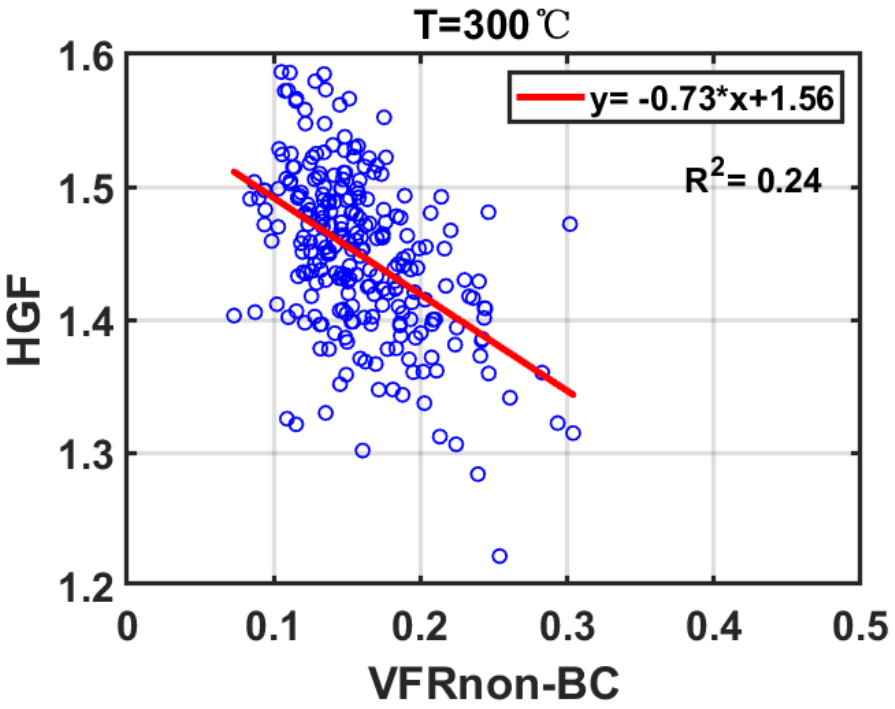


Figure 4. Correlation between HGF and the $VFR_{\mathrm{non}BC}$ of 145nm particles at 300℃.

- The non-volatile residual material were hygroscopic (HGF=1.45)
- Except for BC, non-volatile residual material at 300℃ may be sea salt, low-volatile ammonium or organic polymer.