Sucrose is known to stay in liquid at -25 °C (precipitation temperature). Room temperature is 25 °C in this experiment.

The plot below shows ice nucleation data collected in the deposition mode, at water sub-saturated conditions, relevant to cirrus cloud regime. Clear temperature dependence hints on a pore condensation and freezing (PCF) mechanism in most BC particles tested. The oxidized sample froze homogeneously in all scenarios while a non-oxidized sample with the same morphology showed heterogeneous behavior. The morphological properties affect the dimensions of water confinement in cavities and therefore the onset of ice nucleation.

 Organic coatings enabled inhibition or enhancement of IN activity.

Effects of cooling rates on the glass transition temperatures of isoprene-derived epoxide (IEPOX), which shows cooling rate could change $T_g$ by 5-6 K.

Compounds with similar $T_g$ may not necessarily follow the Gordon-Taylor equation. Compounds with drastically different $T_g$ (>10-20 K) follows better with the Gordon Taylor equation.

The plot to the left shows the relationship between the saturation vapor pressure and the glass transition of the organic compounds determined from this study and literature, with $R^2=0.9$.

$$\log(p/\text{mmHg}) = 0.910 \times \log(T_g/\text{K}) + 0.0400$$

The equation can also be related to the effective saturation vapor pressure and $T_g$

$$T_g = 25 \log_{10} \left( \frac{p}{M} \right) + 172.75 \text{ (K)}$$

The plots above show the possible effects of water content and cooling rates on the glass transition of organic aerosols, following the potential relative humidity trajectories. They show that cooling rate could change the glass transition by 400-800 meters.

**Glass Formation and Ice Nucleation of Organic Aerosols**

**Conclusions and Acknowledgement**

**The systematic study of ice nucleation of black carbon particle types indicates that surface chemistry and microstructures of the soot play a role in ice nucleation properties.**

**The glass transition temperatures of the organic aerosols can be influenced by cooling rate and relative humidity. Experimental study combined with modeling shows that an increasing cooling rate from 2 K/min to 10 K/min can reduce the glass transition by 4-6 K, equivalent to 400-800 meters of height in the troposphere.**

**Controlling the temperature history of secondary organic aerosol particles, such as they can form glasses, increases their ice nucleation activity.**

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