

Interactive comment on “Humidity-dependent phase state of SOA particles from biogenic and anthropogenic precursors” by E. Saukko et al.

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We thank the referee for the critical and detailed review. Here we reply to some of the major comments in order to clarify some critical aspects of the work presented in this paper. A full response to the comments will be submitted later.

- First, we would like to stress that our current technique has evolved from that used in Virtanen et al. (2010). In Virtanen et al (2010) bounce was detected by measuring the current induced by impacted particles. Thus, in addition to particle bounce properties, calculated “bounce factors” depended on charge transfer properties of particles to the substrate. The data presented in this paper were collected using a new method which directly measures the fraction of bounced particles (see Saukko et al., 2012). Hence the “bounce factor” (measured in Virtanen et al. 2010) and the “bounced fraction”

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(measured in this study) are not directly quantitatively comparable. We will further clarify the difference in the revised manuscript.

- Potential RH-surface effects are unlikely in the case of amorphous particles based on many laboratory experiments we have performed. Winkler (1974) concluded that for <75% (in an impactor) changes in particle bounce are related to changes in water content of the particles. But obviously, an interesting question is, why AS particles behave clearly differently compared to the amorphous solid particles. This is a topic of future research.

We cannot entirely exclude the possibility of the formation of liquid layer on the particle surface in the case of amorphous particles as suggested by the referee. We will add discussion related to this matter into the revised manuscript.

- The referee makes several comments on the DRH of the particles. In the case of solid amorphous material there is no well-defined deliquescence/efflorescence RH and the particles take up and release water gradually with changing RH (Koop et al., 2011). Thus sharp changes in the properties (bounced fraction or other) are not to be expected.

- Based on results presented by Tong et al. (2011), the reviewer suggests that residence times in our system are not long enough to allow water diffusion into the particle bulk.. Tong et al. measured equilibrium timescales of longer than 10 000 sec for amorphous sucrose particles ($\sim 8 \mu\text{m}$ diameter), corresponding to a water diffusion coefficient of 10^{-10} to $10^{-11} \text{ cm}^2/\text{s}$ in the glassy state (Zobrist et al., 2011). However, the present work uses SOA particles $\sim 100 \text{ nm}$ in diameter. We have an equilibrium timescales of 3 s (in humidifier RH) and $\sim 0.9 \text{ s}$ (in impactor RH), which for a 8 micron particle would correspond to an equilibrium timescale of $\sim 6000\text{-}18000 \text{ s}$, in agreement with the measurements by Tong et al.

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