

Interactive comment on “Importance of atmospheric aging in reactivity of mineral dust aerosol: a case study of heterogeneous reaction of gaseous hydrogen peroxide on processed mineral particles” by Y. Zhao et al.

Anonymous Referee #1

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General comments

Zhao et al have examined reactions of H₂O₂ on pre-treated Al₂O₃ surfaces, which have been exposed to nitric acid or SO₂. They discuss the observations of nitrate or sulphate dependent uptake coefficients in terms of a mechanism involving two sorts of H₂O₂ uptake, one driven by active-sites (dominant at low RH and low nitrate) and one driven by H₂O (dominant at high RH and e.g. high nitrate). Whilst the results show some interesting trends, it is not clear how any of this data or its interpretation can be extrapolated to atmospheric mineral aerosol, which is not Al₂O₃ and which

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will presumably behave completely differently with respect to uptake of nitrate, SO₂ or H₂O. The amounts of all trace gases used have little bearing on atmospheric mixing ratios yet there is no discussion or supportive data (e.g. experiments at various H₂O₂) to convince the reader that the use of lower concentrations would lead to the same conclusions. The methodology used is known to generate uptake coefficients which may be orders of magnitude too low. Indeed, in the conclusions, the authors have to scale their results by a factor 10000 to align them with data measured using dispersed aerosol.

Overall the paper is rather thin, both lacking in detail and seemingly based on few experiments. I would suggest the authors conduct some similar experiments on either Saharan or Asian dust (or a number of different components of mineral aerosol) before publication in an atmospheric science journal.

Specific comments

P28568, L21 Time dependent H₂O₂ data is used to derive the uptake coefficient using equations 1 and 2. This data should be shown. Also, given the experimental set-up and explanation as to how was the interaction time was calculated should be given.

P28570, L9 How was the surface nitrate concentration calculated. What assumptions were used. How reliable is this number ? The same question applies for the SO₂ processed particles and the surface concentration of sulfite or bisulfite. In the nitrate case, the authors mention that liquid-like water may drive the uptake at high RH. But this would surely be evident in the FTIR spectra ?

P28571, 28572 The text on page 28571 (lines 3-18) largely repeats itself on lines 17-29) and on lines 1-11 of the next page.

P28571 (and Figure 2) When no nitrate is present, the maximum uptake coefficient is found at zero RH. This would seem to contrast the statement that the uptake is driven by available water at high nitrate.

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P28574, L14-15 6.2 % of the BET surface is covered by a (full) monolayer ? Does this imply that the other 94 % has zero S(IV). This is not how adsorption isotherms work.

Figure 1 The FTIR traces appear to have been offset. This needs to be stated in the caption.

Figure 3 The insets have illegible captions

Figure 4 How many experiments were averaged to get the uptake coefficient at each RH ? How were the error bars derived ?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 28563, 2011.

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