

***Interactive comment on* “Heterogeneous uptake of gaseous hydrogen peroxide by Gobi and Saharan dust aerosols: a potential missing sink for H₂O₂ in the troposphere” by M. Pradhan et al.**

Anonymous Referee #2

Received and published: 11 May 2010

This study reports the first measurement of the uptake coefficient of hydrogen peroxide on authentic mineral dust surfaces. The experiments were performed in an aerosol flow tube under nearly realistic atmospheric conditions. The observed uptake coefficient scaled with the relative humidity during the reaction. The authors further applied a photochemical box model to evaluate the potential effects of this reaction as a potential sink for hydrogen peroxide in the atmosphere. Given the widespread abundance of hydrogen peroxide in the atmosphere and its importance in HO_x cycling, this study is of substantial novelty. While the data set is relatively limited with respect to the range of concentration and reaction time, it includes a variation of relative humidity, which is appreciated. The paper is overall well written and structured. It could profit from a more

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

in depth discussion of the data, the potential mechanism and a few critical caveats. A few specific aspects should be considered before final publication in ACP.

Section 2.1: since XPS provides the surface composition, it would be interesting to note any differences to bulk composition, which might be known for these samples.

Is suspension in water and nebulizing and drying considered deleting any memory of previous exposure of the dust samples to ambient air?

The differences in size distribution of the two samples (apart from one being sand and one being transported dust, a point to note and discuss on its own) indicates that they do not respond to the production method the same way. To what degree are the results affected?

Section 3.1 Kinetic analysis: The discussion of the diffusion correction to correctly account for the wall loss is confusing. The method of Brown allows retrieving a true wall loss rate from the measured loss rate in absence of aerosol. Since rather the effective (measured) wall loss rate determines its contribution to equation (1), it is not clear why the Brown method is being used at all.

Section 3.3: P11091, top lines: it is mentioned that some surface sites may have dissociatively adsorbed H₂O₂ on them. What is the mechanism the authors have in mind?

What fraction of the surface sites has been reacted with H₂O₂ during the residence time in the flow reactor. While the data are consistent with 1st order conditions over the time scale of the experiments, separate experiments over longer reaction times might have been helpful to see whether deactivation occurs or whether the process appears catalytic.

The authors should at least discuss in some depth the difference to their own observations on TiO₂ aerosol published recently.

Since H₂O₂ is miscible with water, can a solution form on the surface based on the

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

thermodynamic properties at the concentration of the experiments?

Last paragraph in this section: what are the specific photocatalytic effects the authors would expect for H₂O₂? Photocatalysts are often a source of H₂O₂ in aqueous systems.

Section 3.4: P11093: may the heterogeneous self reaction of HO₂ on dust particles be of any significance as a source of H₂O₂?

Since the box model does not keep track of the dust composition: what is the integrated loss of H₂O₂ per dust surface area over the period the simulations were run, and is this number comparable to the exposure in the experiments? This question relates to the one above about the potential time dependence.

Technical: P11088, line 18: from a kinetic run P11089, line 17: Knudsen P11095, line 23: for collecting the Gobi sample

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 11081, 2010.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper