Referee comments ACP STXM (second round)

1. For HO2 uptake coefficient, for most Cu-doped aerosols, the uptake coefficient is somewhere between 0.5 and 1. Please see Figure 2 in this paper (www.atmos-chem-phys.net/10/5823/2010/), which compiles laboratory measurements of HO2 uptake coefficient and demonstrates how Cu significantly enhances HO2 uptake coefficient for aerosols.
2. While the gas-phase HOx influx is likely minimal in this experimental setup, it could be still significant if HO2 uptake coefficient is high.

We would like to thank the reviewer for this additional comment, related to the choice of gamma of 10^{-2} to estimate the influx of HO_2 into the particles. We would like to mention that since 2010, the year of the publication mentioned by the reviewer, a number of laboratory studies have been published that allow to better constrain the highly uncertain gamma values known from earlier work. The IUPAC Task Group of Atmospheric Chemical Kinetic Data Evaluation has therefore updated its previous recommendations (Ammann et al., 2013) to reflect these new studies here: Task Group on Atmospheric Chemical Kinetic Data Evaluation (accessed on April 22th, 2025). Uptake of HO_2 to aqueous particles is driven by the self-reaction of HO_2 in the aqueous phase and the reaction with transition metal ions. It is also strongly pH dependent to acid dissociation of HO_2 and its impact on the effective solubility. The overall uptake can be parameterized using a resistor model formulation suggested by Thornton et al. (2008). While several of the lab studies were on purpose performed at high transition metal ion contents to constrain the kinetics of bulk accommodation and reaction in the bulk aqueous phase, realistic transition metal ion concentrations (dominated by Fe) are in the 10^{-4} to 10^{-3} M range (see e.g., review by Al-Abadleh, 2024). Taking the preferred values for the rate coefficients provided by IUPAC, representative gamma values for different particle sizes, transition metal ion concentrations are provided in the figure below, justifying the choice of 10^{-2} as representative uptake coefficient for typically acidic (pH around 4 and smaller) submicron aerosol. A diffusion coefficient of HO_2 of 10^{-9} cm^2 s^{-1} was taken representative for an organic rich aqueous solution at moderate water activity.

Wa have added and revised the following text in the Conclusion section from line 489: 'Uptake of gas phase HO_2 to aqueous particles is driven by the self-reaction of HO_2 and by the reaction with transition metal ions (TMI). Following the recommendation by IUPAC (Ammann et al., 2013) with its most recent updates available at iupac.aeris-data.fr, γ is around 1×10^{-2} for moderately acidic aerosol, TMI content in the mM range (Al-Abadleh, 2024) and particle diameters of d = 500 nm. With an HO_2 concentration in the gas phase of 1×10^{8} cm^{-3} an influx of HO_2 of 1.8×10^{-6} $M^{-1}s^{-1}$ is obtained. This influx is almost three orders of magnitude lower compared to our modelled HO_2 production rate in the condensed phase of about 5×10^{-4} $M^{-1}s^{-1}$. And even when comparing to an extreme case with TMI content of 1 M and thus an order of magnitude larger HO_2 uptake, the internal HO_2 production remains higher. Thus even in presence of copper, the internal HO_2 production remains very important.'

References

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