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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Heterogeneous reaction of HO_2 with airborne TiO_2 particles and its implication for climate change mitigation strategies" *by* Daniel R. Moon et al.

Anonymous Referee #1

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The work assesses the chemical reactivity of a potential candidate aerosol composition (titania) for geoengineering via the injection of stratospheric aerosol, a solar radiation management type approach to geoengineering. In particular the heterogeneous reaction of HO2 upon titania is assessed. The measured uptake coefficients show only negligible effect upon stratospheric ozone chemistry.

This is well executed science that combines rigorous laboratory work with global modelling. In particular, the kinetic data looks excellent (figures 2 and 3). A plausible explanation for the RH dependence is provided via a molecular model. The results are put in context and appropriate conclusions are reached. The manuscript is well writ-

ten. I have no major comments and I am happy for this to proceed to ACP post haste. I provide a few minor comments below.

Minor comments:

P2 L41 "showing sulphate aerosols to be unsuitable for solar radiation management" - this line is too strong. There are arguments why sulphate, or indeed any aerosol, should not be used. But if aerosol injection is to be considered, then sulphate is a significant contender by virtue of being nature's choice. i.e. in its favour is that there are natural experiments (volcanoes) with which to evaluate its performance and there are unlikely to be any surprises. The same cannot be said of titania.

P4 L96 - be more precise about the temperature that the experiment was conducted at, provide mean and standard deviation, rather than $\sim$293 K.

P4 L98 - what is the flow tube material? What wavelengths of light are omitted when the flowtube is shrouded?

P5 L117 - what form of titania was used (rutile, anatase etc.)? N.b. the surface characteristics of different forms of titania might have different surface reactivity.

P5 L136 - why do the particle diameters vary under different RH conditions? Titania is not significantly hygroscopic (as shown later in the paper with only monolayers of water being present at RH < 70%) so what is causing the size changes? Is it size dependent particle losses?

P11 L265 - define Vbridge

P14 L349 - only one SEM image is shown, presumably other images showed similar sphericity to the particle shown in Fig.7?

P366 L366 - note that a gamma of 1 implies every collision is reactive. This result maybe implies the laboratory work was not required?

P15 L388 - insert "to" in "...in order (to) follow..."

P16 L395 - the deviation between the consequences of N2O5 uptake between this study and the study of Tang et al. is interesting. A plausible explanation is provided but the authors are encouraged to discuss this discrepancy with the Tang et al. modellers (if they have not already).

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