

Reply to reviewer 2.

(Authors reply is in blue)

The authors are encouraged to extend the Experimental section. Since the centrepiece of the work is experimental data, it is very important to give a full description of the instrumental setup, procedures and detection methods.

1. Detection. Give a short description of mass spectrometry system used. If electron impact was used give EI energy. Which signals (raw) were monitored, how the signals were calibrated, what were the sensitivities and detection limits? It is prerequisite to provide a separate figure, which depicts a typical uptake experiment (preferably showing raw massspec signal).

Short description of MS (including EI energy, calibration procedure and detection limits) is added: section 2.2, 1st paragraph.

We did not present a raw mass spectrometric registration corresponding to a typical uptake experiment, considering that this would, in fact, duplicate the data presented in Figure 4. However, following the referee's comment we have included in the manuscript the NO₂ detection limit, so that the reader can have an idea on the signal to noise ratio during monitoring of any NO₂ concentration.

2. Add additional text to describe the way relative humidity was adjusted and detected. How water did prepared mixing ratio inside flow tube compared to real-world tropospheric values? Did humidity affect NO₂ signal?

A comment on the measurements of the absolute concentrations of H₂O in the reactor is added: section 2.2, 1st paragraph.

Yes, at highest RH used, the NO₂ signal was affected (decreased) in presence of water in the ion source. However, the NO₂ signal could be calibrated in independent way at any RH used.

3. Provide information on helium flow tube flowrate used (in volume units) for 1-10 torr range.

Done: section 2.2, 1st paragraph.

4. BET surface area is usually measured for particular powder samples. If BET surface area was measured in this work then the description of the method should be provided. Otherwise add the text describing which BET value was used.

In this work the BET surface area was not measured, we have used the value provided by the powder supplier, which is mentioned in section 2.1. The BET value used in the calculations is mentioned again (added) in section 2.3, 4th paragraph.

5. From Experimental 2.1 section it is unclear how the thickness of the coatings was controlled during preparation. This needs to be described in details.

The thickness of the coating was not controlled, only the mass of the coating was measured. However, the thickness can be estimated using the mass data, TiO₂ density and diameter of the support tube given in the text.

Due to a significant number of parameters it would be very useful to expand figure captions so that each caption contains information on TiO₂ sample mass, NO₂ initial mixing ratio, number of lamps switched on (or mentioned dark experiment), flow tube pressure and temperature.

Done

P27867 L13-16 The linear dependence shown on Fig.5 suggests that NO₂ reacts not only at the surface but diffuses inside the coating. This is quite critical for data interpretation and deciding how the uptake coefficient should be calculated and presented.

The authors are encouraged to look at Underwood et al. (2000 J.Phys.Chem.) paper where such an analysis is given and consider geometric versus BET surface area arguments.

In fact, our analysis of the mass dependence presented in Fig. 5 is completely identical to the "Application of Linear Mass-Dependent (LMD) Regime" proposed by Underwood et al. in the cited paper.

Minor suggestions:

P27862 L17-20 This text should be moved into Discussion section. Abstract should contain the major findings and the products described belong more to the planned future publication.

Done

P27865 L12-14 The conditions of this experiment are very different from the others. Why such a high NO₂ mixing ratio was used and such a slow residence time? Provide explanation for using this settings.

In these experiments the NO₂ photolysis frequency was measured. The rate of this process is much lower than those of the heterogeneous reaction. That is why the conditions of these experiments are different; in particular the NO₂ residence time in the reactor is higher. Rather high NO₂ concentration is needed to favour O+NO₂ reaction against possible O atom loss on the wall.

P27866 L5 Nitrogen dioxide molecule velocity should be given for the temperature range used in this work.

Done.

P27866 L20 Fig.4 not Fig.3

Actually it is Fig.3.

P27866 L24-P27867 L3 Consider revising this paragraph. These three sentences are perhaps redundant as they echo previous statement.

In fact, the experimental data from different experiments (Fig.3 and Fig.4) are discussed. Although these data demonstrate the same effect (sample deactivation), we believe that they all deserve consideration.

P27867 L12 Add text, indicating assumption made about homogeneous, evenly dense coating.
Done.

P27867 L17 Define clearly “initial uptake coefficient”. Which exactly time period is used to calculate gamma initial?

The initial uptake coefficient was measured during the first 10-30s of the sample exposure to NO₂. Comment is added in the text.

P27868 L22-24 The argument of “NO₂ photolysis frequency similar to above” is questionable. Firstly, with cooling liquid running to maintain T=280K, the intensity of light reaching inside is expected to be decreased. Secondly, the above photolysis experiments were performed at slower residence time.

The presence of the cooling liquid was found to have a negligible impact on the NO₂ photolysis frequency.

The photolysis frequency (in s⁻¹) does not depend on the residence time.

P27873 L15 Check the value of “90 ppb of NO₂” because it looks like this NO₂ mixing ratio is outside of range P27868 L12-13.

Seems to be OK: 90 ppb (at P = 1 atm) corresponds to [NO₂] ≈ 2×10¹² molecule cm⁻³. Pressure is specified in the text.

Figure 5. Missing y-scale units.

Corrected