

## ***Interactive comment on “Heterogeneous reaction of N<sub>2</sub>O<sub>5</sub> with airborne TiO<sub>2</sub> particles and its implication for stratospheric particle injection” by M. J. Tang et al.***

**Anonymous Referee #1**

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acp-2014-75 Submitted on 28 Jan 2014 “Heterogeneous reaction of N<sub>2</sub>O<sub>5</sub> with airborne TiO<sub>2</sub> particles and its implication for stratospheric particle injection” M. J. Tang, P. J. Telford, F. D. Pope, L. Rkiouak, N. L. Abraham, A. L. Archibald, P. Braesicke, J. A. Pyle, J. McGregor, I. M. Watson, R. A. Cox, and M. Kalberer

The research carried out on the uptake of N<sub>2</sub>O<sub>5</sub> on TiO<sub>2</sub> was done very systematically and the manuscript is well written. The manuscript describes the determination of the uptake coefficient of N<sub>2</sub>O<sub>5</sub> on TiO<sub>2</sub> particles at room temperature for the first time. Since the refractive index of TiO<sub>2</sub> is more than 60% greater than that of H<sub>2</sub>SO<sub>4</sub> particles, main light scattering particles in the stratosphere, it requires much less amount to

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inject into the stratosphere to reduce the global warming. Unlike H<sub>2</sub>SO<sub>4</sub>, TiO<sub>2</sub> would not presumably activate chlorine production to cause ozone-destroying chain reaction. Consequently, it would increase stratospheric ozone, thereby lowering photolysis rates in the troposphere and increases in N<sub>2</sub>O<sub>5</sub> concentration.

I have only some minor comments:

1. page 4424, para 1: How much TiO<sub>2</sub> has to be injected into the stratosphere to have a perceptible impact? 2. What are other pathways for N<sub>2</sub>O<sub>5</sub> loss on TiO<sub>2</sub> than just hydrolysis? Is it possible to have NO<sub>2</sub> produced as a result of the uptake? In such a situation, what would be the impact in terms of ozone depletion? 3. page 4430, lines 15-24: This assumption is fine on a relative scale. However, one N<sub>2</sub>O<sub>5</sub> does not give one NO<sub>2</sub> and one NO<sub>3</sub>. There is always some loss of NO<sub>3</sub> to give NO<sub>2</sub> + O<sub>2</sub>. 4. Page 4434, line 10- 25: It is good to see a detailed and rigorous of the diffusion correction. However, diffusion correction for small uptake coefficient values is negligible. Page 4438, line 13: “P25” should be “P2.5”

This paper is by no means a complete study as pointed out by authors regarding the photocatalytic activity of TiO<sub>2</sub>. However, it did a comprehensive experiment and discussion of the results on the uptake of N<sub>2</sub>O<sub>5</sub> on TiO<sub>2</sub> particles

Page 4441, line 29 (last line): “feedbacks” should be “feedbacks”.

This manuscript should be accepted addressing a few minor points.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/14/C1505/2014/acpd-14-C1505-2014-supplement.pdf>

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