

Interactive comment on “Ozone decomposition on Saharan dust: an experimental investigation” by F. Hanisch and J. N. Crowley

Anonymous Referee #1

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General Comments: This study addresses the interaction of ozone with real dust samples and provides initial and steady-state values for the reactive uptake coefficient. The authors are careful to examine, explain, and correct for the dependence of their observations on the mass of the bulk sample used. In this way, their results can be extrapolated to the case of suspended particles in the atmosphere. Similarly, the authors investigate the dependence of ozone uptake on the concentration of ozone so that the laboratory results can be correctly applied under atmospheric conditions. Experiments regarding the possible passivation and regeneration of the surface are also discussed. The work appears to have been performed with significant attention to detail and will make an excellent contribution to the scant body of knowledge regarding the role of heterogeneous loss of ozone on airborne dust and other crustal materials. This manuscript is well written and clearly presented.

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Specific Comments: 1. The different densities discussed can lead to confusion; please elaborate. To what does the phrase "true density" (p. 1817, line 20) refer? Is that the density of a single grain of dust (presumably averaged over many grains)? Is that what the pycnometer measures (which you call simply "density" on p. 1813, line 14?)

Please explain more carefully how the "bulk density" is determined. On p. 1813, line 15, you imply that each bulk sample had a known geometric surface area and uniform thickness (which was measured to determine its volume) and was weighed to determine the overall density of the prepared sample. But then on p. 1817, line 21, a single bulk density of 1.2 g/cm³ is reported. Does this mean that each sample prepared had the same ratio of mass to measured volume? to what precision?

It seems circular to me to say in lines 2 and 3 of p. 1818 that the heights are calculated from the bulk density, when on p. 1813 you state that the bulk density was determined from the height!

2. p. 1816, Eq. (2): What is the uncertainty in $S(\infty)$? Is there a physical basis for this expression?

3. p. 1819, line 20: Can you suggest an explanation for your observed dependence of gamma on [O₃]? What physical process leads to "the enhanced availability of reaction sites at lower O₃ concentrations"? Do you have a hypothesis for the discrepancy between your observation and the [O₃] independence reported by Michel et al. (p. 1821, line 8)?

4. (p. 1825, line 26, or p. 1828, line 28) This manuscript does an excellent job of explaining how the results can (and cannot) be appropriately applied to models of the atmosphere. To put things in perspective, can you provide a rough idea of the time it would take for ambient dust particles to transition from the initial to the steady state regime, and then to the passivated regime? If one were to ignore the reactivation of surfaces, could you estimate if dust would become passivated towards ozone within an hour, a day, or a month?

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Technical Corrections: p. 1824, line 26 should read "dependence on [O3]" Capitalization in references is not consistent. Also, p. 1832, line 1: "Japanese" should be capitalized. Fig. 9 axis should be labeled in seconds, not minutes

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