Atmos. Chem. Phys. Discuss., 3, S2339–S2341, 2003 www.atmos-chem-phys.org/acpd/3/S2339/ © European Geosciences Union 2004



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Interactive Comment

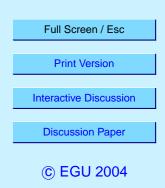
Interactive comment on "On the influence of fuel sulfur induced stable negative ion formation on the total concentration of ions emitted by an aircraft gas turbine engine: comparison of model and experiment" by A. Sorokin et al.

## Anonymous Referee #1

Received and published: 12 January 2004

Summary: The paper discusses the introduction of a free model parameter  $f_{det}$  describing the relation of the electron detachment efficiency of sulfur bearing ions  $(SO_x^-)$  and  $O_2^-$  ions in the combustor of an aircraft engine. Because of the higher electron affinity of the sulfur bearing ions the conversion of  $O_2^-$  into  $SO_x^-$  ions changes the electron detachment efficiency and consequently the chemiion concentration in the exhaust plume. The paper performs a sensitivity study of  $f_{det}$  and discusses the influence of the chemiion formation rate Q. The modelling results are compared with measurement results performed at the exit plane of an aircraft engine combustor.

Comments: Because important modelling inputs are presently unknown (e.g. ion for-



mation rate, temperature dependent rate constants, details of the ion evolution) the paper investigates the influence of the electron detachment efficiency treated as a (currently freely adjusted) parameter on the concentration of chemiions at the exit plane. The paper discusses an interesting aspect of chemiion evolution that might have a major influence on the total chemiion concentration at the exit plane, but the presented sensitivity study of  $f_{det}$  alone and without any further constraints seems to be only a small step forward in understanding chemiion evolution in an aircraft engine, especially when considering that the qualitative statement (that the differences observed in the experiment are a result of the differences in electron detachment) is apparently already stated in Haverkamp et al. (statement in the manuscript's introduction). A more detailed study about the influence of the detachment efficiency on the total chemiion concentration should include  $f_{det}$  as a time-dependent variable. As the ion evolution proceeds in the post-combustor zone, the concentration of the more stable ions increases and  $f_{det}$  decreases. Does this have an influence on the exit plane ion concentration? What would be the expected influences of combustor temperature and temperature development in the post-combustor zone? In the low fuel sulfur content setting, in how far do other stable ions like  $CO_3^-$  or  $NO_3^-$  replace the sulfur-bearing ions?

The authors should also compare their results with the detailed model by Starik et al., Aerospace Sci. Tech., 2002. Does their model yield any new/different results? The model by Starik et al. treats all the separate ion species explicitly.

Currently, a description of the experimental results is not available because the cited paper by Haverkamp et al., 2003, has not been published yet. Therefore, a more detailed description of the experimental results would be helpful, especially error bars indicating the uncertainty of the experimental results should be added.

Technical correction: from fig. 5 and from the text it seems that the experimental arrow for HSFC should be located at  $2x10^8$ , whereas fig. 1 indicates  $3x10^8$  (tickmark  $2x10^8$  is covered by model data).

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