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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Coagulation of combustion generated nanoparticlesand their measurement behind vehicle engines:can they play a role as atmospheric pollutants?" *by* H.-H. Grotheer et al.

H.-H. Grotheer et al.

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1)The objection is correct. The title question should read. "Can they (i.e. nanoparticles) survive an exhaust train and be released into the atmosphere?". In a revised version of this manuscript this title question will be used. Actually, it is already contained in the Introduction of the present manuscript, where it is clearly said "Goal of the present study is a contribution to the question whether nanoparticles can be released in significant amounts into the atmosphere."

2)At the end of the Introduction the scope of this work is defined as a contribution to

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the nanoparticle release from engine exhausts. As pointed out, we have undertaken two approaches. (i)to estimate rate coefficients for the first coagulation step in a flow reactor study, (ii)to measure nanoparticles directly behind vehicle engines. Both groups should yield the same answer to our question, yet they lead to apparently conflicting results. In the Discussion an explanation to resolve this conflict is considered. In the meantime we have carried out more measurements that support these views. Perhaps it would be prudent to write a more detailed Discussion or to supplement the text by a "Note added in proof".

3)This objection is not understandable. In order to show differences between nanoparticles and soot, these differences are listed in the Introduction and no less than 11 references referring to this issue are given.

4)The expression "supersonic" can indeed be found twice in the text and it is used to describe the nozzle (not the beam) between burner and flow reactor. As the pressure ratio is about 120/1, this description seems to be correct. In fact, this is of minor importance as the purpose of this nozzle is to provide a separation between these two stages as reported in the text. We do not say, however, anything to characterize the beam exiting this nozzle. This would be meaningless since this beam merges into the carrier gas, He. In addition, there are many bath gas and wall collisions in the reactor so that any original features of the beam are rapidly lost. Consequently, the considerations of Kamphus et al. (Proc. Comb. Inst. 2002) referring to a free molecular beam, do not apply to our case.

5)With regard to coagulation it is said by the referee that the experiment is not reported although Figs. 5 and 6 show time evolutions of our measured mass profiles. Concerning the evaluation, indeed a mishap occurred. In the text a footnote number is given referring to an accompanying paper, yet this footnote simply got lost in the course of editing this manuscript. The citation of this paper is "Pokorny, H., Thierley, M., Grotheer, H.H., Aigner, M.: The fast coagulation of combustion generated nanoparticles (NOC), Proc. European Combustion Meeting, Louvain, April 2005". It contains

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details of the evaluation. In the author's view it is completely in order and common practise to present a result in abbreviated form when details are reported elsewhere. I disagree with the referee's statement that "the hard facts within this paper are measurements of rate coefficients". In my view it is considerably more important, that we got mass spectrometric signals (for the first time) behind real vehicle engines that we attribute to combustion generated nanoparticles. These particles that were earlier referred to as "young soot" are quite often assumed to transform entirely into mature soot and, consequently, to play a role only as transient species in flames. If, however, these particles are released from automobile exhausts as suggested by studies carried out in Naples (see References) and by the present study, our motorized society may face a severe problem which merits more research and more attention.

6)Mild ionisation is a good idea when one has sufficient signal. Using very rich flames we could indeed measure mass profiles under those conditions. They show PAH like patterns under high resolution and remain unaffected upon a moderate increase of the laser pulse energy (cf Fig 3). For bikes, however, even recent re-measurements failed under conditions of mild ionisation. The industrial DI engine is currently not available to us and will be re-examined in near future.

7)We learned that for the sampling of reactive gases a brand-new sampling line should not be used as it is, but rather should be conditioned by running it over, say, half an hour. After that time the signals become stable.

8)No problem. In a revised manuscript these additional results can be shifted to the Results section.

Author's final remark: According to reply #5 the detection of nanoparticles behind engines is regarded as potentially very important. This importance is underscored by measurements in a DLR laboratory showing an unexpectedly high toxicity of nanoarticle samples for bacteria cells as well as human lung cells. Consequently, in order to avoid any undue delay of the publication we will attempt to comply with reviewers'

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suggestions as far as possible.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 3847, 2005.