

PMP – Particle Measurement Program Informal Working Group

Task Force 2– Brake Dust Sampling and Measurement

Meeting #18 – Thursday 14 February, 2019, 14:00 – 15:00

Minutes of Meeting – Final Version

1. Tour de table: Participants: AVL-(TM) Thanasis MAMAKOS; BMW-(RL) Rasmus LEICHT; BMW-(KL) Katharina LAMMEL; BREMBO-(FR) Francesco RICCOBONO; CARB-(SC) Sonya COLLIER; DEKATI-(MM) Mikko MOISIO; Ford-(JG) Jarek GROCHOWICZ; Ford-(MM) Marcel MATHISSEN; GM-(MR) Matt ROBERE; HORIBA-(DL) Dmytro LUGOVYY; ITT-(SA) Simone ANSALONI; Hiro HAGINO; JRC-(TG) Theodoros GRIGORATOS; Link-(RM) Radek MARKIEWICZ; Link-(RV) Radi VEDULA; Opel-(OB) Olaf BAUSCH; TMD Friction-(AP) Andreas PAULUS; TSI-(SP) Stephan PERCOT; TU Ilmenau-(DH) David HESSE; TU Ilmenau-(TF) Toni FEISSEL.

2. Presentation of the TF2 Strategy: TG briefly presented the proposed TF2 strategy to the participants with the aim of receiving feedback regarding the way forward.

TG provided a feedback regarding the discussions at the GRPE Meeting in Geneva. The key message is that the activity will remain at the GRPE level for at least one year after the expiration of the current mandate. ***DG-GROW required for the method to be completed by the end of 2019 and tested until mid-2020 with the aim of providing brake wear PM and PN emission factors.***

TG provided a brief overview of the TF1 activities. TF1 will complete testing in February 2019 and make a first evaluation of the results by the next PMP Meeting (4 April, Brussels). Afterwards, a validation exercise will be performed by TU Ilmenau – BMW and the final report is expected to be released by June 2019. TF1 should communicate technical aspects to TF2 as soon as the first results are evaluated.

TG briefly discussed the TF2 status. So far, discussions on the methodology led to a draft document which summarizes the current state of knowledge within the group. TG will circulate a clean version of this document as it will be used for future reporting. ***TG highlighted that after the release of the cycle there was an agreement to distribute the reference brakes among the different labs with the aim of performing some tests and providing some first emissions results and insights.*** Overall, 9 laboratories received the reference brakes but very few results have been shared so far. ***TG asked for some results to be presented in the next TF2 meetings and the next PMP Meeting.*** These results will be used as basis to take decisions regarding the methodology. DL (Horiba) and MR (GM) stated that they could present some preliminary results from their on-going testing campaigns.

TG introduced some topics that still remain open and should be answered in the following weeks/months. ***Fundamental questions regarding the cycle are related to the long soak time between the trips and the control of the cycle (time vs. temperature).*** AVL-TUI showed at the last PMP Meeting that reducing soak times does not have a big effect on the brake temperature. ***TG asked TF2 participants to bring data on this topic to the next TF2 Meeting (Thursday 28 Feb) and see if we can reach an agreement on how to treat soak times.*** SC raised the issue of measuring PM and PN emissions during soak time as it would introduce an artefact. MM mentioned that for PM measurements it is inevitable, while for PN it won't be much of an issue since brake temperatures are decreasing to low levels. An estimation of the introduced artefact for both PM and PN will be required. Different opinions exist regarding the control of the cycle. ***For the time being all tests will be performed with the time controlled version which is being tested extensively at TF1 level.*** TG

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mentioned that the time controlled version is the preferred one at a political level. If future data demonstrate that the time controlled version introduces an error that cannot be accepted, while the temperature controlled version does not, then the TF2 will revisit the topic. RV showed some data obtained with the novel cycle under different conditions. The temperature of the cooling air seems to significantly influence the temperature profile of the brake system. Since vehicle measurements were conducted at relatively low environmental temperatures (<10°C) it may be the case that more flexibility shall be allowed when reproducing the temperature profile on the dyno under different conditions (20°C, RH 50%). **TG asked TF2 members to bring to the group's attention any other questions or issues related to the application of the novel cycle.**

Measurement related topics can be summarized to the application (or not) of isokinetic sampling, the application (or not) of thermal treatment to exclude volatiles and the use of diffusion chargers for measuring PN concentrations. Regarding the isokinetics there are concerns for high losses of particles >1µm. This will compromise PM_{2.5} and PM₁₀ concentrations. **Data will be required to show that PM_{2.5} and PM₁₀ are not affected otherwise isokinetic sampling will be applied to the proposed methodology.** Regarding the volatiles TG requested some experimental results on the same sampling system with and w/o a thermal treatment in order to evaluate the situation. DL mentioned that volatiles could be crucial for some types of pads while for others not. **TG asked for results with as many different pads as possible; however, decision regarding the proposed methodology should be taken in the timeline described below based on available data.** Regarding the DCs there is a suggestion from some TF2 members to include them in technologies for measuring PN concentration. Some experimental results on the same sampling and brake system with the prevailing technology (i.e. CPC) and DC will be required to understand whether DC can be included to the proposed methodology. **TG asked TF2 members to bring to the group's attention any other questions or issues related to the sampling and measurement procedure.**

Finally, TG proposed a way forward. There is a suggestion to use the next 2 months for data collection and to try to answer to some of the open questions. Then a reference system will need to be defined. The requirements for the reference system should be discussed in the next months and after the PMP Meeting. The reference system should be defined by the end of May 2019 and before the next GRPE Meeting in June. A testing period shall follow with the aim of defining the method and the minimum specifications. **TG asked TF2 members to provide their feedback on the proposed approach as well as other ideas/directions.**

3. Next Meeting: Next TF2 meeting will take place on February 28th. Main topic of the meeting will be soaking times.