Portable Nano-Particle Emission Measurement System

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Publishable Executive Summary

The PEMs4Nano project addresses the development of measurement technology and procedures down to 10nm, providing a contribution to future regulation on particle emissions, in particular under real driving conditions. The activities planned in the project will also support the understanding, measurement and regulation of particle emissions below 23 nm (with the threshold of at least 10 nm).

Tackling environmental concerns for both fuel consumption and noxious emissions with newest technologies may also lead to the emission of smaller nanoparticles that may be undetected by current certification procedures. PEMs4Nano has the goal to develop measurement procedures that are robust, reliable and reproducible for both the development of the new engine technologies (based on current direct injection gasoline engines), as well as for serving as a solid basis for new regulations. Taking on this ambition has the advantage of establishing a systematic content-based link between development activities and regulation. Two complementary measurement systems will be optimized for use in the development laboratory and for mobile testing based on current technologies. Given the numerous parameters associated with the engine (combustion and exhaust systems) technologies and measurement procedures, physico-chemical and data-driven simulations combined with optimization methodologies are proposed to gain vital understanding for formation and dynamics of the particles and to establish valuable correlations between measurements made in the development laboratory and thus finally those measured on the road.

The project begins with a work package 1 on Requirements and Concept (WP1), which is important for setting the stage for PEMs4Nano and making sure that the other work packages are properly aligned. WP1 ensures that the necessary interfaces between the work packages are in agreement and synchronized to establish what interactions and information fluxes within the work packages are necessary in order to achieve the specific goals. The ambitious targets have been confirmed by the partners from their perspective by considering how their specific work will support reaching these targets. This has been carried out independent of the work package structure by defining focus areas that connect the work packages at a higher level of abstraction to tackle the cross-work-package targets in a holistic way and ensure that there are no gaps in the project. The focus areas are:

- model-guided application (MGA)
- preparation of measurement technology,
- development of measurement procedure and application (MPA)

A common understanding of the specific requirements is vital for the success of the PEMs4Nano project. In order to do this, each of the focus areas starts by identifying and documenting the ambitious targets from the

perspective of that focus area, with respect to what needs to be achieved in that area and also including what benefits will result from achieving these targets as specified by the detailed requirements.

Additionally, each focus area provides the necessary technical background information in order to provide a better understanding of the context surrounding the actual values that are specified and documented in the deliverable, e. g. understanding what is meant by the efficiency of volatile particle removal or the dilution of exhaust gases to prepare them for actual measurement. The specifications are quantified and documented with specific performance values or ranges, or boundary conditions that are relevant for the actual measurements in the laboratory or in the field. Finally, technical risks associated with the focus area have also been documented.

Examples of topics that require cross-work-package discussion can be found both in the area of boundary conditions and ambitious performance goals. One very important boundary condition is the choice and handling of testing fuels. In order to ensure a well-grounded approach to tackling correlations between measurements it is not sufficient to simply require that all use the same type of fuel in their experiments, but to require that actual fuels used have the same chemical composition and best sourced from the same fuel supplier. Fuels age over time, so it has been agreed that the current fuels used will be analysed in regular intervals and on a ongoing basis. The area of model-guided application is a central topic that is expected to benefit both the preparation of measurement equipment (e. g. supporting parameter settings to minimize particle losses) as well as measurement procedure. In particular, the ability to estimate exhaust composition based on numerical simulations will have a strong impact on placement of extraction points in the exhaust line and the interpretation of measurement results under various boundary or operating conditions and at the tailpipe. A particular challenge specified in the deliverable will be the support of ensuring “good” correlation between the different test environments, especially between laboratory and on-road vehicles.

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Project partners:

#	Type	Partner	Partner Full Name
1	IND	HORIBA	Horiba Europe GmbH
2	IND	Bosch	Robert Bosch GmbH
3	IND/SME	CMCL	Computational Modelling Cambridge Limited
4	IND	TSI	TSI GmbH
5	HE	UCAM	The Chancellor, Masters and scholars of the University of Cambridge
6	HE	ULL	Université des Sciences et Technologies De Lille – Lille I
7	IND	IDIADA	Idiada Automotive Technologie SA
8	IND	HORJY	Horiba Jobin Yvon S.A.S.
9	IND/SME	UNR	Uniresearch BV

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