Portable Nano-Particle Emission Measurement System

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Publishable Executive Summary

Typical particulate formation models for internal combustion engines have focused on describing carbonaceous (soot) particles, which have historically been the dominant particulate emission type in terms of mass and number. Novel exhaust after treatment (particulate filters) and engine (gasoline direct injection) technologies have caused other, liquid-like, particulates to become increasingly important when considering particulate number emissions. Thus, current particle formation models are not well suited to modelling particulate emissions from modern vehicles. To address this concern, a novel particulate formation and evolution model that includes a description of liquid-like particles has been formulated and implemented into the SRM Engine Suite software.

A simulation platform was formulated in a previous deliverable (D3.2) to consider the particle evolution from engine-out up to the measurement device. This platform consists of two stages. In the first stage, the particles at engine-out were simulated by considering in-cylinder processes such as detailed combustion chemistry, emissions formation pathways, turbulent mixing, heat transfer, direct injection, etc. In the second stage, a reactor network model was used to simulate the particle sampling system. This is where liquid-like particles are formed and they are known to affect the quality of the measurements. The reactor network model was used to assess the effects of different dilution ratios on the formation of inorganic particles.

In this report, surrogate models are generated from the outputs of the calibrated detailed model. These surrogates are constructed so that they can be used in a vehicle simulation. This is because the surrogate models can be evaluated in real-time, so are well suited for inclusion in transient vehicle simulations. It is infeasible to use a detailed model in a transient vehicle simulation as they are computationally expensive to run.

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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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