PEMs 4Nano

Portable Nano-Particle Emission Measurement System

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Publishable Executive Summary

Typical particulate formation models for internal combustion engines have historically focused on describing carbonaceous (soot) particles, which were the dominant particulate emission in terms of mass and number. The advent of exhaust after treatment devices (for example, diesel particulate filters) and engine technologies (for example, gasoline direct injection) have caused other types of particulate to become increasingly important when considering particle number (PN) emissions. For this reason, existing particle formation models are not well suited to modelling particulate emissions from modern vehicles. To address this concern, a novel particle formation model has been formulated and implemented in the stochastic reactor model SRM Engine Suite software™ developed by CMCL. The model includes the presence of metallic ash formed during the combustion process and a soluble organic fraction (SOF) formed by the condensation of semi-volatile organic compounds (VOCs) on the particles.

A simulation platform has been developed to consider the particle evolution from engine-out to the measurement device. The simulation platform contains two parts. In the first part, the particles at engine-out are simulated by considering detailed in-cylinder combustion chemistry. In the second part, a Model Guided Application (MGA) has been developed and used to simulate the particle sampling procedure for the PN measurement. The influence of dilution ratio on the PN measurement procedure is investigated. Lastly, the MGA is applied to size-resolved particle chemical characterization of the emitted particles and validated with a mass spectrometry analysis.

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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.
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