

PROJECT SUREAL-23: UNDERSTANDING, MEASURING AND REGULATING SUB-23 NM PARTICLE EMISSIONS FROM DIRECT INJECTION ENGINES INCLUDING REAL DRIVING CONDITIONS

Aerosol and Particle Technology Laboratory (APTL)

A Presentation to the PMP Group – May 2018



PMP meeting on 16th & 17th May, 2018

# Outline

- SUREAL-23 approach
- Project's methodology
- Advanced particle sampling/treatment
- Advanced instrumentation
- Indicative applications
- Conclusions



### **SUREAL-23** Partnership





### **SUREAL-23 Status**



- Deliverables are on schedule.
- Two measuring technologies are in the prototyping phase.
- Project website is online: http://sureal-23.cperi.certh.gr.

## SUREAL-23 Workplan



# **Technology Development and Testing**



### Sampling / Conditioning



### **Advanced Catalytic Stripper**







- A plethora of mixed oxides were synthesized and tested for their SO<sub>2</sub> adsorption capacity
- A double function monolith was impregnated with the most efficient powders and addition of Pt



> C40 removal efficiency

9

- $\succ$  SO<sub>2</sub> adsorption
- Solid particle penetration



### **CS Evaluation**



The catalytic stripper meets the current but also possible future PMP demands with >99.9% oxidation efficiency up to Q=20 lpm for concentrations >10<sup>6</sup>particles/cm<sup>3</sup>.

The complete **S** adsorption capacity is **7.3mg** or **0.31g/l** of catalyst volume while the overall 23.1mg or 0.98g/l.



## The Advanced half-mini DMA (SEADM)

### The concept of HM-DMA



#### The goals achieved

High resolution in the sub-23nm particle size range (4 – 30 nm)





16.3

16.1



SMPS

HM-DMA

10

Co-financed by the European Union Connecting Europe Facility

- Accurate hot operation up to 200°C (Reduced exhaust aerosol conditioning, Measurements with a single hot dilution stage)
- Fast response time (100 ms; 10 times higher response capability than traditional electrometers)
- Compactness (2 cm working section)

## Automotive ICAD (FHNW)

### The concept of Diffusion Charging







### The goals achieved

- Operate at high temperature (150°C) to allow minimum dilution
- > 50% counting efficiency at 11.5nm
- Absolute sensitivity increased



# Testing Platforms (APTL, IM, IFPEN, CRF)

#### Vehicle Testing on chassis dyno and road

- Euro 6 Diesel DI
- Euro 6 Gasoline DI
- Euro 6 Gasoline DI/PFI







Portable emissions measurement system (PEMS) instrumentation







Co-financed by the European Union Connecting Europe Facility

13

### **Conclusions – Next Steps**

### SUREAL-23 next Steps:

- Finish developments for all proposed instruments
- Perform measurements to a variety of testing platforms (Test Matrix)
- Chose among best solutions for PEMS application



#### Aerosol & Particle Technology Laboratory - CPERI/CERTH

Dimitrios Zarvalis Eleni Papaioannou Penelope Baltzopoulou Apostolos Tsakis Leonidas Chasapidis Danis Deloglou Manos Daskalos Anastasios Melas

The work presented was conducted within the EU-funded project SUREAL-23 (Grant Agreement no. 724136)

# Thank you all

