

# Programme

- **9.30** Introduction to MetroHyVe project
- 9.45 Overview of the day
- 10.00 Gas sampling devices (overview)
- 10.30 Gas sampling vessels (overview)
- 11.00 Break
- 11.30 Particles sampling (overview)
- 11:45 Health and safety
- 12.05 Lunch
- 13.00 Head over to the hydrogen refuelling station for a visit

# METROLOGY *for* HYDROGEN VEHICLES

## Introduction to MetroHyVe

*Oliver Büker, Karine Arrhenius - RISE*

Workshop on Hydrogen sampling training course  
12<sup>th</sup> of March 2020, Delft, The Netherlands

# Metrology for Hydrogen Vehicles



What are the main measurement challenges for hydrogen vehicles?

# Metrology for Hydrogen Vehicles



What are the main measurement challenges for hydrogen vehicles?

## CHALLENGE 1: FLOW METERING (OIML R 139-1)



Refuelling stations cannot cost their customers with required accuracies

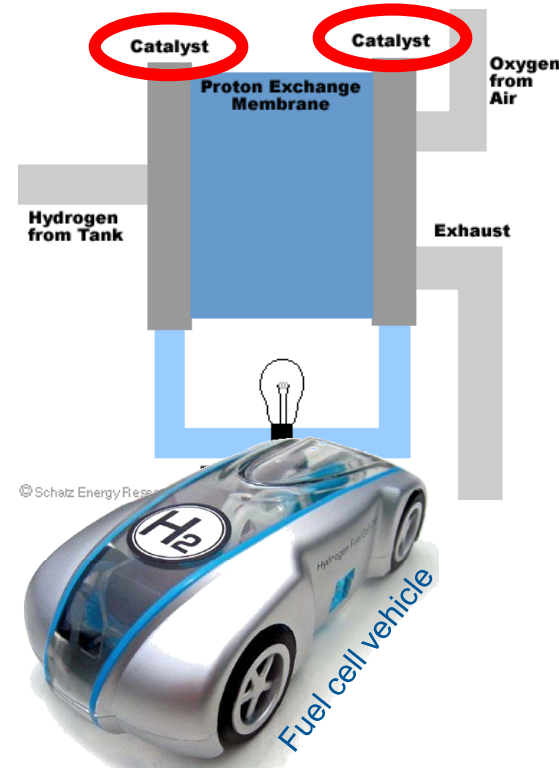
Flow meters in the refuelling station must be accurate to 1% (OIML R 139-1)

Hydrogen supplied can vary up to 700 bar in pressure and between -40 to 85°C during refuelling

Unknown mass of hydrogen is lost during venting

What are the main measurement challenges for hydrogen vehicles?

## CHALLENGE 2: QUALITY ASSURANCE (ISO 14687-2)



### Reactive gases

•Water	(5 µmol/mol)
•Oxygen	(5 µmol/mol)
•Carbon dioxide	(2 µmol/mol)
•Total hydrocarbon compounds	(2 µmol/mol)
•Formic acid	(0.2 µmol/mol)
•Carbon monoxide	(0.1 µmol/mol)
•Ammonia	(0.1 µmol/mol)
•Total halogenated compounds	(0.05 µmol/mol)
•Formaldehyde	(0.01 µmol/mol)
•Total sulphur compounds	(0.004 µmol/mol)

### Inert gases

•Helium	(300 µmol/mol)
•Nitrogen	(100 µmol/mol)
•Argon	(100 µmol/mol)

### Non-gases

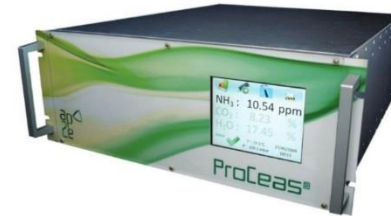
•Particulates	(1 mg/kg)
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## CHALLENGE 3: QUALITY CONTROL (ISO 19880-8)

What are the main measurement challenges for hydrogen vehicles?



Traceable gas reference standard



Validation of online analysers



Confidence at refuelling station



## CHALLENGE 4: SAMPLING (ISO 19980-1)

What are the main measurement challenges for hydrogen vehicles?



Hydrogen refuelling station



Hydrogen purity laboratory

Selection of  
sampling vessel

Correct sampling  
procedure

# Metrology for Hydrogen Vehicles



WP1: Flow metering



WP2: Quality assurance



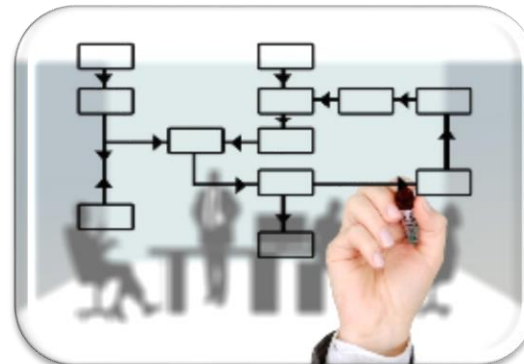
WP3: Quality control



WP4: Sampling



WP5: Creating impact



WP6: Management

20 project partners:

June 2017 – May 2020

Project co-ordinator:  
 Arul Murugan



# All activities

## WP1 Flow metering

- Task 1.1 – Identifying uncertainty sources
- Task 1.2 – Calibration using safer gases (nitrogen or air)
- Task 1.3 – High pressure calibration using water or oil
- Task 1.4 – Developing a primary gravimetric standard
- Task 1.5 – Uncertainty budget for type approval testing

## WP2 Hydrogen quality assurance

- Task 2.1 – Analytical methods for reactive compounds
- Task 2.2 – Laboratory measurement of particles
- Task 2.3 – Gas reference standards for low level impurities
- Task 2.4 – Hydrogen impurity enrichment device
- Task 2.5 – Lowering cost of performing analysis
- Task 2.6 – Interlaboratory comparison

## WP3 Hydrogen quality control

- Task 3.1 – Online measurement of gas impurities
- Task 3.2 – Online measurement of humidity
- Task 3.3 – Online measurement of particles
- Task 3.4 – Low cost sensors
- Task 3.5 – Intercomparison of online analysers

## WP4 Sampling

- Task 4.1 – Gas sampling techniques
- Task 4.2 – Validation of particle sampling
- Task 4.3 – Sampling using sorbent tubes
- Task 4.4 – Sampling vessels

**All activities can be found on our website:  
[www.metrohyve.eu](http://www.metrohyve.eu)**