

# **Metrology for sustainable hydrogen energy applications / Hydrogen quality specification for fuel cell vehicles**

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## **Abstract**

The new European policy objectives in the transport and energy sectors defined in the Horizon 2020 Research and Innovation programme encourage the decarbonisation of the transport sector in order to reduce the greenhouse gases effect. This policy is in line with the requirements of the European Directive on the deployment of Alternative Fuels Infrastructure 2014/94/EU. Hydrogen, as an energy source, is a clean and storable solution that could meet the worldwide energy demands in the future.

Hydrogen (H<sub>2</sub>) is a non-toxic gas and contributes to the reduction of greenhouse gas emissions as its oxidation generates only water. It is expected that hydrogen for transport will allow 77 % CO<sub>2</sub> reduction from well-to-wheel in 2030. It can be easily produced from electric power issued from renewable energy sources as sunlight, wind and hydraulic power, from biomasses by different processing technologies. Hydrogen has a wide range of energy applications either stationary or mobile such as combined heat and power generation or transportation. The increasing number of hydrogen applications generates normative needs related to safety and cost-effective use systems. Metrology provides to the standardisation bodies the guarantee of validated techniques and traceable analysis measurements by test comparison performed at the highest accuracy levels.

One of the newly rising applications within automotive industry is the Fuel Cell Electric Vehicles (FCEV). The hydrogen purity dispensed at hydrogen refueling points should comply with the technical specifications included in the ISO 14687-2 standard [1], but the rapid progress of the fuel cell electric vehicles and related technology will require revising the currently standard normative.

The Gas Laboratory of the National Measurement Institute of Spain (CEM), with academic support from University of Valladolid (UVa), through the 2015 Call for The European Metrology Programme for Innovation and Research (EMPIR), participates in the project "15NRM03 - Hydrogen Metrology for sustainable hydrogen energy applications" that is coordinated by the Laboratoire National de Métrologie et d'Essais (LNE).

The overall objective of this project is to address the standardisation needs in the fast emerging sector of hydrogen fuel, evaluating the probability of hydrogen impurity affecting fuel cells (Ammonia, Ar, CO, CO<sub>2</sub>, formaldehyde, formic acid, H<sub>2</sub>O, He, N<sub>2</sub>, O<sub>2</sub>, total halogenated compounds (HCl), total hydrocarbons compounds, total Sulphur compounds) and developing analytical techniques for traceable measurements of the hydrogen impurity, including tolerance levels for impurities in hydrogen and limits for the degradation of fuel cell performance.

The Gas Laboratory of the National Measurement Institute of Spain (CEM) is developing optimised methods and gas standards for the hydrogen impurity analysis leading to the implementation of the ISO 14687-2. In this poster, the results of the first stages in impurity risk assessment and purity analysis will be showed.

[1] ISO 14687-2:2012 Hydrogen fuel - Product specification - Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles