November 12-13 2024
RamanFest
Paris | FRANCE

Christian R. Günther[a], Lavinia M. Appold[ab]
Alexander Stratmann[b], Cemal Esen[a], Andreas Ostendorf[a]

[a]Ruhr University Bochum, Applied Laser Technologies, Universitätsstr. 150, Bochum, Germany
[b]Robert Bosch GmbH, Postfach 30 02 20, 70442 Stuttgart, Germany

christian.guenther@rub.de, Lavinia.Appold@de.bosch.com

The use of Raman spectroscopy for quality analysis of hydrogen

The optimal functioning of fuel cell vehicles requires the use of high-purity hydrogen (ISO 14687), as impurities can cause both temporary performance issues and irreversible damage. However, production processes, such as vapor reforming, are not the only source of impurities. Contaminants can also be introduced into the hydrogen during subsequent steps its lifecycle. Therefore, it is important to conduct final quality checks at the nozzle to ensure that vehicles are refueled uncontaminated hydrogen. Traditional analytical techniques for assessing hydrogen quality require laboratory-based procedures, making them unsuitable for on-site implementation. In response to this challenge we present a newly developed Raman spectrometer for detecting these impurities. The utilization of small components results in a transportable and robust spectrometer, which allows the analysis of on-site analysis of hydrogen. This development allows a simplified calibration process and operation. The spectrometer is capable of detecting all relevant molecules listed in the ISO 14687 standard, which is shown in this study. This advancement has the potential to streamline the quality control process and facilitate rapid quality control with minimal delay. The presence of a gas matrix can be identified with minimal effort, typically within a few seconds.

Figures

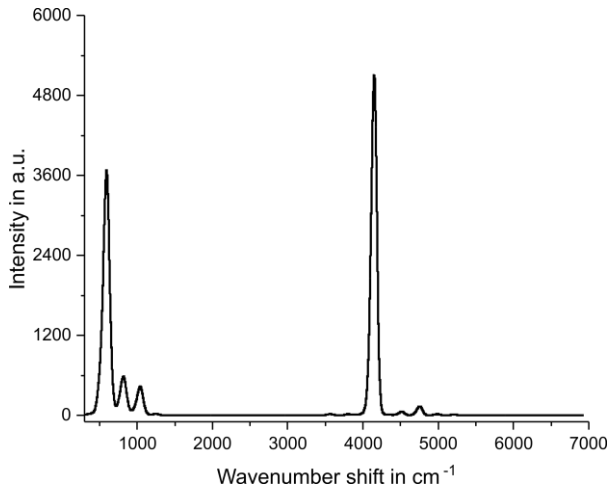

Figure 1: Exemplary spectrum of gaseous hydrogen, excited with a low cost 450 nm laser source. The vibrational as well as the rotational Raman bands are apparent.