Final publishable summary report

The H2Sense project underpins the effective deployment and availability of reliable hydrogen sensors, primarily but not exclusively for use in applications using hydrogen as an alternative fuel. The objective is to avoid any hazardous events which could hinder the implementation of hydrogen as an alternative fuel by ensuring the availability and optimum use of low-cost and reliable hydrogen sensors.

A survey of hydrogen sensors and sensor manufactures was prepared. It shows that more than 400 hydrogen sensing elements, sensors or sensor systems are commercially available. Commercial sensing platforms are based above all on catalytic combustion, electrochemical reactions, thermal conductivity and electrical resistivity changes. Further types are based on work function as well as on optical and acoustic effects. Many sensor suppliers have their headquarters in USA, Germany, Japan and United Kingdom.

Diverse application areas of hydrogen sensors are identified and compiled. Current and new applications include:

- Room/area monitoring for safety where hydrogen may occur e.g. battery rooms
- Detection of leaked hydrogen
- Process monitoring and control e.g. in the petro-chemistry industry
- Stationary and mobile fuel cell applications

Requirements for cost-effective and reliable hydrogen sensors are specific to the application where they are used. With respect to safety deployment, many requirements are stipulated by appropriate international safety standards. Pertinent requirements on sensor performance include response time, selectivity, robustness and lifetime, in addition to maintenance and capital costs.

Performance tests on three sensors based on different sensing platforms under harsh conditions of high temperature and humidity show that all three fulfil general requirements on accuracy and robustness, even though further optimisation is expedient.

The hydrogen sensors market was evaluated and an analysis was performed to identify the potential turnover and market volume for nine market segments. Barriers which may hinder the commercialisation and widespread deployment of hydrogen sensors were identified. These include a lack of end-user's knowledge on recent advances of contemporary hydrogen sensors and deficiencies in sensor performance. Other barriers are the cost of purchase, efforts for installation, deployment and maintenance. Approaches to overcome these barriers were developed.

Recommendations for further RTD activities were elaborated. Further efforts should focus on overcoming performance gaps in relation to selectivity, accuracy, robustness, low energy consumption, long term stability, improved production technologies and reduction of manufacturing and maintenance costs.

A survey on hydrogen sensor related standards was prepared and recommendations for new RCS activities to be implemented at national and global level were devised. Although general standards for flammable gas sensors exist, additional sensor standards are needed for specific hydrogen related applications such as for leak detection or for sensor test protocols in automotive applications.

A novel aspect of this project is the ongoing co-operation and joint activities with the National Renewable Energy Laboratory of the US Department of Energy. As a result of this collaboration output from the project was leveraged by the interaction and knowledge transfer between the European and US partners.

The foreground of this project were shared with the hydrogen community through dissemination on the H2Sense project website, in a workshop on "H2 Sensors – the right one in the right place at the right price", in a brochure on hydrogen sensors, in publications and oral presentations.