New portable, high performance device analyses toxic gases and air pollutants

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Credit: AI-generated image (disclaimer)

Against a backdrop of increased concern about the safety of traded cargo across Europe, the EU-funded IRON project has developed a handheld device for sub-parts per billion (ppb) gas detection based on proprietary mid-infrared laser spectroscopy, combined with patented photoacoustic technology.

Existing devices to analyse toxic gases and air pollutants are limited in terms of their size, performance, versatility and usability. The EU-funded IRON project has developed a miniaturised detector that offers both sensitivity and selectivity to reliably and simultaneously detect small concentrations of multiple gases. This enables a range of new applications from cargo container safety monitoring to explosives detection, opening up possibilities within the growing green economy.

The IRON project solution's reliable detection of small concentrations of hazardous gases has resulted in the introduction of new products to the market including GASERA ONE SHED and GASERA FORMALDEHYDE.

From fixed mount analysers to portable, handheld instruments

The project's technology allows users to simultaneously measure small concentration of gases. As a project member and CEO of Gasera, Dr. Ismo Kauppinen explains, "High selectivity and high sensitivity for multi-gas measurement enables us to provide very competitive technology useful in a number of scenarios such as emission testing in the automotive industry or for formaldehyde measurements in air quality applications."

The device works by sealing sample gas in a measurement chamber. To enable identification, a laser is then used to irradiate the gas with infrared light at frequencies corresponding to those found in known gas molecules. If the sample gas is present in the chamber, some of the infrared energy is then absorbed by the gas, resulting in a localised increase of heat energy, pressure and temperature. This matching process results in the photoacoustic chamber creating acoustic waves of the same frequency, which are then converted into electric signals for a

microphone using patented cantilever technology, 100 times more sensitive than conventional microphones.

As well as being at the frontier of high-end technology, utilising many new components such as lasers, the IRON project solution also exploits technology associated with the Internet of Things. To deliver comprehensive monitoring it uses a cloud based platform to cater for data analysis from a variety of instruments, alongside engaging a variety of communications architectures.

The project has successfully tapped into a pre-existing market for portable analysis devices which require laboratory grade performance. It did so by not focusing exclusively on technical development but also on identifying users' requirements and expectations, especially relating to cargo handling. This enabled the team to develop a unique, scalable monitoring solution that integrated value-added features such as longer battery operation time, shorter measurement time, an avoidance of toxic gas consumables, online analysis and automated notification about hazardous concentrations.

Explaining why there are few solutions currently available Dr. Kauppinen points out, "Awareness of the problem is rather low and so the relevant regulations are not in place which means that comprehensive solutions exist presently only in selected ports." He adds that, "We expect this to change during the coming years as EU policies are expected to improve the safety of international trading."

Sustainable progress without compromising the environment, safety or well-being

The IRON project's technological developments have already contributed to world-class automotive emissions testing (SHED) and air

quality measurements which can identify small concentrations of formaldehyde, usually a very difficult process. The same technology can also be applied to scenarios where the presence of multiple gas components is a huge challenge, including: cargo container safety, indoor air quality monitoring, hidden person detection, explosives and narcotics detection.

Combined these applications direct IRON's current market offering, significantly supporting the EU's safe trading initiatives for consumer protection, social rights and environmental rules. In the shorter term as Dr. Kauppinen says, "We will continually improve our algorithmics with more on-site tests, where laboratory tests are available for comparison. We expect this to get easier as awareness about cargo and warehouse safety grows."

Provided by CORDIS

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