TipChip

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Technology description

Credit card sized, single use mass discriminator that could be used as a near patient diagnostic platform for several conditions such as diabetes, peptic ulcers and liver dysfunction. This technology developed by STFC, UK scales down the large and expensive commercial Mass Spectrometers through innovative design allowing accurate detection of small groups of substances. STFC invites interested parties in developing single specific solutions in different Industrial sectors.

TECHNICAL DESCRIPTION

This technology initially developed for the ESA’ s Rosetta Mission, overcomes the two major issues faced by Mass Spectrometers – Size and Price. The innovative design comprises of two chambers, a sampling and analysis chamber separated by a rupture membrane, making the device a single use or disposable instrument. The electrode and magnet setup within the analysis chamber allow for the discrimination between a small number of ions, rather than identifying any ion species like the larger MS of the industry. The sample chamber may be an open or closed chamber. If closed, this may be by an admission valve arranged for the introduction of the required sample into the sample chamber.

One of the current applications of the technology is proposed in the field of medical diagnostics. The technology uses breath tests to diagnose medical conditions such as stomach ulcers; this will enable patients suffering from suspected stomach ulcers to be tested for species of bacteria called Helicobacter Pylori (H. pylori) at their doctor’ s surgery in minutes and with laboratory-standard accuracy, by the detection of C13 CO_2 exhaled by patients treated with C13 labelled urea. The bacteria use breakdown urea into CO_2 & ammonia, the latter allowing neutralization of stomach acidity for its survival. In order to accomplish this, the instrument needs to be able to discriminate between C12 CO_2 and C13 CO_2 in a breath sample.

H. pylori are the most common cause of stomach ulcers. It is estimated that more than a quarter of people in the UK become infected with the bacteria at some stage in their life. Unlike most other bacteria which are killed by the acid in our stomachs, H. pylori use the aforementioned technique to blanket itself from stomach acidity. The ulcers are a result of the lesions created by the attack of the body’ s immune response against the bacteria living in the mucosal membrane of the stomach lining. To confirm their diagnosis many patients are currently referred to hospital. They are given a liquid to swallow, which is broken down by the H. pylori bacteria to produce a gas, and then have their breath tested to see if the bacteria is present using a large and expensive machine called a mass spectrometer. Tip Chip has made a breakthrough in this type of medical technology as it works in a similar way but is

almost credit card sized making it possible in the future for doctors to carry out these tests from their own surgery.
The technology could provide a simpler way of enabling both doctor and patient to find out what is wrong at the point of care and identify the best course of treatment much more quickly. This could reduce the burden on the national health services and free up many hospital appointments to be used for other medical conditions.
INNOVATIONS
Many novel solutions were developed to achieve the miniaturization and reliability required for the instrument, including the use of shape memory alloys for the gas release mechanism and nanotechnology electron sources to build the world's smallest ion trap mass spectrometer.
SPACE HERITAGE
Scientists involved in developing the tiny mass spectrometer were formerly engaged in producing the Ptolemy instrument for the Rosetta mission. Rosetta is a European Space Agency-led (ESA) robotic spacecraft mission launched in 2004, intended to study the comet 67P/Churyumov- Gerasimenko.

Application area

Medical diagnostics
Customs, detection of contrabands

Advantages

Portability is one of major advantages as the unit is about the same size of a credit card.
Disposable nature of the technology allows easy regulatory approval as well as reduced risk of cross patient contamination.

Institution

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