Australian National Fabrication Facility
ACT Node & WA Node
NEWSLETTER
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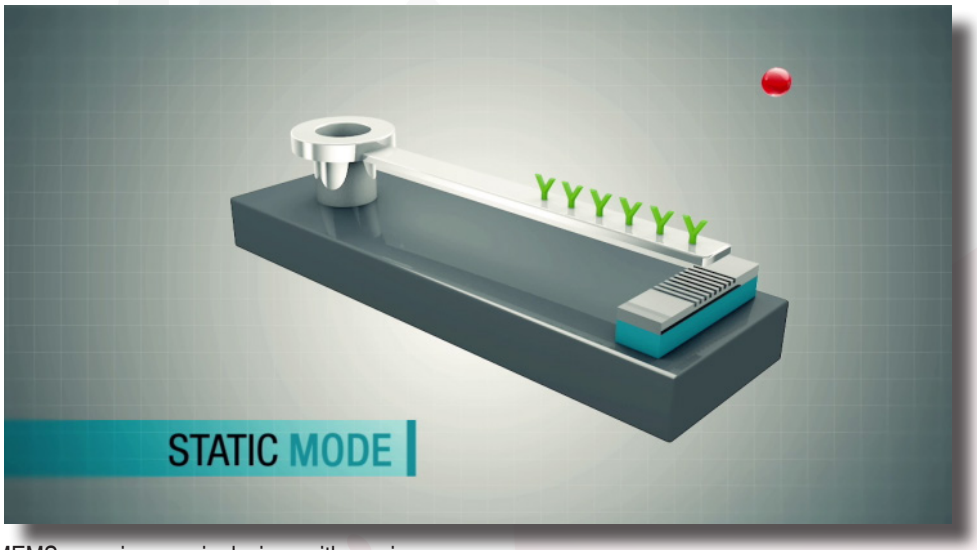
A Nose for Business!

An artificial nose (previously reported in our June 2013 issue) based on micro-electro-mechanical systems (MEMS) is moving towards commercialisation due to a partnership between the Microelectronics Research Group (MRG) at the University of Western Australia (UWA) and the company Panorama Synergy.



MEMS are microscopic devices with moving parts of size typically between 1 to 100 micro-metres in size. The artificial nose technology is based on MEMS micro-cantilever sensors, here, tiny mechanical cantilevers are coated with an analyte which preferentially bonds to the substance to be detected. When the bonding occurs, surface stresses cause the micro-cantilever to bend, giving an indication that a sensing event has occurred (see Fig. 1 above/opposite).

One particular problem preventing the mass adoption of micro-cantilever sensors is the difficulty in measuring the bending of the micro-cantilever. Current read-out techniques to measure the bending of the micro-cantilever involve the use of either integrated electronic techniques based on capacitance or piezo-resistive effects; or external optical techniques such as the use of quadrant photodetectors for optical beam deflection.

Generally speaking, whilst electronic read-out techniques are capable of measuring the movement of large numbers of cantilevers, they can only do so with very low resolution.

Alternatively, traditional, external optical read-out techniques can measure the bending of the micro-cantilever with very high resolution, but cannot be used to measure large numbers (>8) of micro-cantilevers. The use of multiple micro-cantilevers is necessary in this style of sensing to provide temperature compensation and better measurement statistics.

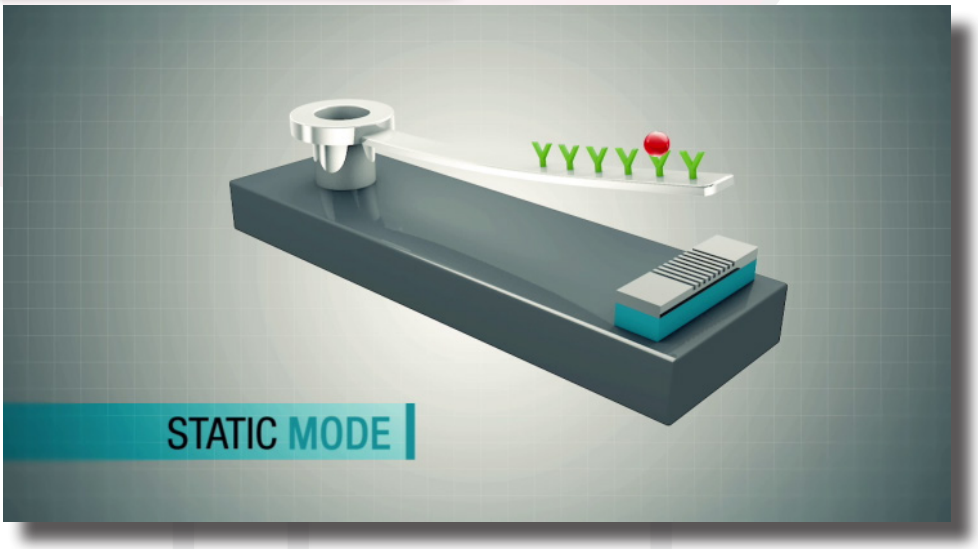


Fig. 1: Static mode operation of a MEMS gas sensor. When the detection event occurs, surface stresses cause the micro-cantilever to bend

Researchers at MRG have blended silicon photonics techniques with MEMS to develop a novel, integrated optical read-out technique which provides both optical measurement resolution and the ability to address large numbers of multiple cantilevers (Fig. 2 over).

This is done by etching a diffraction grating beneath the micro-cantilever, creating an optically resonant cavity. Light travelling through the cavity is modulated by the movement of the micro-cantilever, providing an extremely sensitive measurement of the micro-cantilever bending.

Over the course of the last few years, UWA PhD candidate Gino Putrino has demonstrated the ability of this technique to measure the movement of the micro-cantilever with pico-meter-scale accuracy, and has used this ability to measure the thermally stimulated Brownian motion of micro-cantilevers as small as 100 micrometres in length.

The technology is the subject of four international (U.S.) patent applications, one of which has already been allowed by the United States Patent & Trademark Office (USPTO) patent examiner.

UWA has recently signed a licensing agreement with Panorama Synergy (PSY), granting them a minimum 50% share of revenues.

On 8 November 2013, Gino presented the technology in California at the MEMS Executive Congress. The following week, the share price of PSY rocketed 4000% before settling back down. Prior to the presentation PSY had a market capitalisation of $1.3 million, at the time of writing, PSY has a market cap of

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$38.4 million. This rapid rise has not gone unnoticed in finance circles, and has been reported in mainstream media such as the Australian Financial Review, and the Finance News Network. Panorama Synergy was also one of the top ten most discussed stocks for several weeks on notorious Australian share market forum HotCopper. This work continues to gain a lot of attention, and the research is currently being continued via an ARC Linkage Grant between UWA Microelectronics Research Group and Panorama Synergy.

Story by Gino Putrino, Microelectronics Research Group, The University of Western Australia.

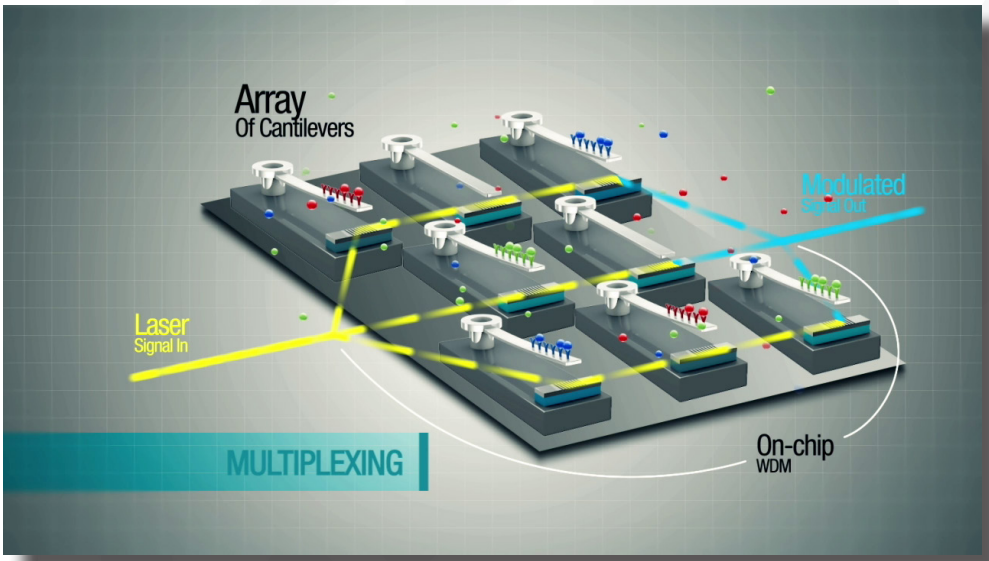
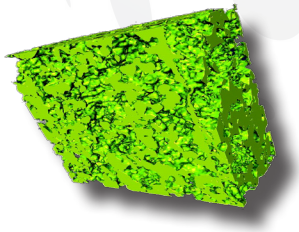


Fig. 2: Wavelength division multiplexing (WDM): a broadband laser is split using on-chip WDM to detect the movement of multiple micro-cantilever sensors. The micro-cantilevers can be coated with different functionalisations for detecting different chemicals.

ANU/UNSW Startup Company sells for $76 Million



3D reconstruction of a rock sample

Lithicon AS, a company started by researchers at the Australian National University and UNSW has been sold for $76 million (US$68 million) to the US-based FEI Company.

ANFF has supported the long time research effort that has led to the development of Lithicon AS. In 2009, researchers at ANU and UNSW set up a company called Digitalcore, which merged with Norwegian company Numerical Rocks AS in 2013 to form Lithicon AS. Their research developed advanced computational and high-resolution 3D imaging techniques that solve fluid behaviour calculations in mineral core samples. Working with some of the world's biggest resources companies they have developed techniques that generate critical information needed to determine the best way to extract oil and gas. ANFF has supported their research at the ACT Node. Working with node's focused ion beam (FIB) system and expert staff the Lithicon team have developed a high resolution 3D imaging technique for mineral core samples with features too small to be imaged via their alternative method, X-ray CT scanning. The technique uses a focussed gallium ion beam to mill a small hole in the sample. Using the scanning electron beam integrated into the FIB system, the edge of this hole can be imaged. Images of subsequent slices milled from the edge of this hole can be combined to create a single 3D image with nanometre resolution.

"Together with ANFF, we have been leading the application of these (FIB) systems on rock samples to produce nanoscale 3D images of tight unconventional geological systems such as shales and tight gas" said Dr Victor Pantano, General Manager of Lithicon AS. "This work is important as these geological samples cannot be analysed using traditional means, and thus the work with the ANFF provides a means of characterising these increasingly important oil and gas bearing formations."

Today, Lithicon AS employs 18 people in Canberra and markets its services to resource companies around the world. The merger will allow the group to further develop its research in the field, which will remain headquartered in Canberra.

ANFF would like to congratulate Lithicon AS on reaching this very significant milestone, and looks forward to supporting their future R&D efforts in strengthening their position as world leaders in digital core scanning and analysis.

Story by Dr Warren McKenzie, ANFF Business Development Manager

This issue of our newsletter reads more like something out of an investment magazine with articles from both the WA Node and ACT Node reporting developments that have had an impact on financial markets both here in Australia and internationally.

Not only is this good for the companies involved, investors and institutions alike, but it is also a positive reflection on the ANFF itself and the value of the facilities it provides and the contribution it makes to industries developing new technologies that benefit the community as a whole.

Further reading on these stories can be found here:

Panorama Synergy/ANFF WA Node:

Australian Financial Review - Panorama Synergy spikes 4000pc on HotCopper tip
http://www.afr.com/p/markets/panorama_synergy_spikes_pc_on_hotcopper_Kwyqx8WYX6LcJXML5yi13O

Panorama Synergy
http://www.panoramasynergy.com.au/IRM/content/default.aspx

Lithicon AS/ANFF ACT Node:

ANU News - $76 million startup sale
http://news.anu.edu.au/2014/02/10/76-million-startup-sale/

Lithicon - Digital Rock Technology
http://www.lithicon.com/

We look forward to more success stories like this in the future. (JK)

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