Taking mass spectrometry to the next dimension

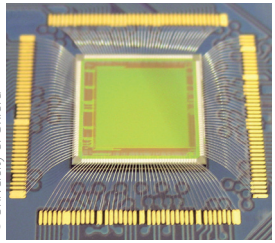
A new pixelated measurement system could revolutionise mass spectrometry, by redefining the way its detection systems work.

UNIVERSITY OF OXFORD

www.physics.ox.ac.uk

Pixel Imaging Mass Spectrometry, or PImMS for short, is a technology born out of a collaboration between the University of Oxford's Department of Physics and Department of Chemistry, along with the Rutherford Appleton Laboratory. By replacing existing detection systems with a new breed of array-based sensors, these academics hope to transform the way the analytical technique is performed.

Mass spectrometry is normally used to identify unknown compounds and analyse the structure of molecules. In its most common form, a single, large electrode is used to detect ions created when a molecule is broken up, and time-of-flight information is used to calculate their mass. The PImMS project, however, provides fast, array-based imaging capabilities, which allows simultaneous acquisition of mass and structural information.



The collaboration has recently produced a prototype device which uses an array of 72x72 intelligent pixels, inspired by technology originally developed for use in detectors for linear particle accelerators. Each pixel is capable of detecting ions and providing up to four separate mass peaks, in effect making each of the pixels an individual mass spectrometer. Across the entire array, the new device is capable of producing images that accurately depict the complete velocity or spatial distribution of the ions at their point of formation. This transforms mass spectrometry from a one-dimensional weighing technique into three dimensions: a realm where spatial and velocity information can be provided as a function of mass.

Understandably, there is significant commercial interest in the project, and for good reason: this development offers a wide range of possible industrial applications. Not only does it allow rapid analysis of molecular structures and their masses, but the system can provide molecular imaging of surfaces, in a single shot - much like taking an image using a digital camera. It also heralds the arrival of high-throughput sampling: the 2D array can allow a large number of spectra to be acquired in parallel, making more efficient use of mass spectrometry systems.

A number of the new cameras have been produced to be tested by academics and collaborators - and initial experiments are extremely positive. In fact, they are already working to increase the resolution to 340x340 pixels and the sampling rate by an order of magnitude. Pimm's and Oxford have always been a synonymous combination - but PImMS might soon be more famous for its connections with the Department of Physics.

www.physics.ox.ac.uk/LCFI

Funded by EPSRC, STFC, RCUK and ISIS Innovation Ltd.