Multimodal bio-image sensor: Fusion of heterogeneous biochemical information

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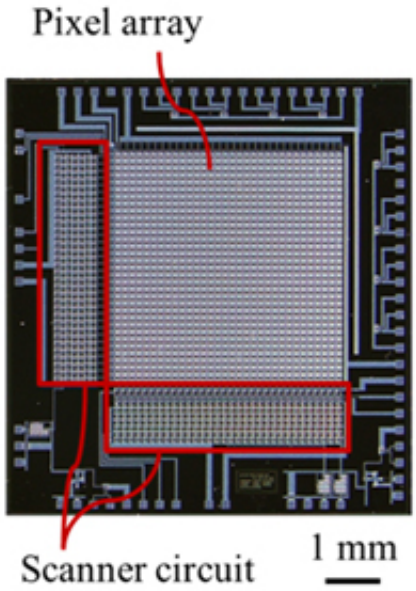

Photomicrograph of an actual multimodal bio-image sensor chip. Credit: Toyohashi University of Technology

The use of sensors is important for the quantitative analyses of chemical materials and physical phenomena, with research and development of biosensors for observing cell function being actively pursued.

Although there are several conventional biosensors that can be used to analyze biological samples from one perspective, the use of biosensors for multimodal analysis is challenging.

In this study, Hirokazu Nakazawa and colleagues at Toyohashi University of Technology (Toyohashi Tech) have devised a multimodal bio-image sensor that can render images of the two-dimensional distribution of proton concentration (pH) and fluorescence intensity for multimodal analyses of biochemical objects.

A prototype of the image sensor was fabricated at using facilities at Toyohashi Tech's EIIRIS research complex using a modified CMOS fabrication process with a 5 μm design rule. The area of each individual sensor region was 54 μm× 40 μm, with 32 × 32 pixels (Fig. 1). The bonding wires and gold electrode pads (except those in the active region) were encapsulated to protect them from the liquid environment.

The multimodal bio-image sensor enabled the detection and display of a wide range of wavelengths of light at 5 frames per second, without the use of optical filters or gratings. The researchers also used the sensor to measure the variation of the pH distribution with time.

These results demonstrate the potential of this imaging sensor for intra- and extracellular measurements. The multimodal analysis approach is effective for obtaining biochemical information in real time using multimodal bio-image sensors with high spatial resolution.

More information: Hirokazu Nakazawa, et al. 'Multimodal bio-image sensor for real-time proton and fluorescence imaging,' *Sensors and Actuators B: Chemical*, in press, DOI:10.1016/j.snb.2011.11.010

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