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QUANTIC

The UK Quantum Technology Hub
in Quantum Enhanced Imaging

IndiPix™ : Mid-infrared sensing and imaging



Today, mid-infrared cameras need cryogenic cooling and specialist materials, making them costly and bulky. Our technology is paving the way towards compact and light-weight mid-infrared imaging systems.

Medium wavelength infrared sensors and cameras can be used for gas sensing, biological imaging, agricultural and food storage applications, and energy and environmental monitoring. Their application, however, is currently limited because of low portability and high-cost. A highly portable, low cost device would unlock new markets and applications.

QuantIC's researchers have developed IndiPix™, a mid-infrared imager based on a unique indium antimonide pixel technology where the pixel is individually addressable thanks to the use of monolithically integrated gallium arsenide transistors. This eliminates the need for a flip-chipped read-out integrated circuit, thereby reducing cost and improving portability. The technology behind IndiPix™ is made possible thanks to a collaboration with Gas Sensing Solutions (GSS), a project partner that supplies hybrid wafers with antimonide layers epitaxially grown on inexpensive gallium arsenide substrates.

The technology has been successfully demonstrated using a single active pixel, 4x4 and 8x8 pixel arrays, all extensively characterised using a laser source emitting at 4.57 μm and presenting excellent electro-optical response uniformity, which allowed it to demonstrate CO₂ imaging. In order to prove the adaptability of the technology, we are working towards sensing and imaging of several gases that strongly absorb mid-infrared wavelengths. A 64x64 array, suitable for entering the market, is also being developed.

QuantIC is also working in collaboration with Compound Semiconductor Technologies Global (CST Global) to transfer the current monolithic technology pioneered by the Hub's researchers to a wafer-level industrial manufacturing line, while exploring additional pixel functionalities such as avalanche detection. Several potential end users, such as M Squared Lasers, Thales, Leonardo and Jaguar Land Rover have expressed their interest in IndiPix™.

Application area	Gas Plume Imaging
Estimated Component Cost	Small volume prototype production expected to be approximately £3k.
Present Performance Specs	Resolution and frame rate, 64x64 pixel at 80 fps. Chip size 10x10 mm, Pixel pitch 110x110 μm, fill factor 25%. Technology is scalable to larger arrays when in production.
Latest Publications	Single-chip, Mid-infrared Array for Room Temperature Video Rate Imaging, C. Xie et al., submitted to the OSA journal <i>Optica</i> InSb photodiodes for monolithic active focal plane arrays on GaAs substrates, V. Pusino et al., IEEE Trans. Electron Dev., 63(8), 3135-3142, 2016 Development of InSb dry etch for mid-IR applications, V. Pusino et al., Microelectron. Eng., 153, 11-14, 2016 Monolithic integration of an active InSb-based mid-infrared photo-pixel with a GaAs MESFET, C. Xie et al., IEEE Trans. Electron Dev., 62(12), 4069-4075, 2015

For more information, please contact:

Dr Michael Fletcher
QuantIC Business Development Manager
michael.fletcher@glasgow.ac.uk

Professor David Cumming
Project Technology Lead
david.cumming.2@glasgow.ac.uk

