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Silicon based infrared detection with very broadband response using plasmonic resonance

Infrared (IR) detection has many important applications for military, communication, astronomy and medicine. Currently infrared detections are mainly based low-bandgap semiconductors like III-V, II-VI, and so on, which mostly rely on expensive apparatuses for epitaxial growth and are disadvantageous for their complicated processes, and complex device structures. Here we present a novel approach that combines silicon photonics and localized surface plasmon resonance (LSPR) structure to achieve ultra-broadband IR detection. LSPR structure has been widely used to increase the absorption of incident photons in many photoactive devices. However, existing LSPR is only induced in a small designed wavelength range or polarized incident light. Our novel concept applies a 3D metallic array structure. The varying length of metallic structures can excite LSPR with ultra-broadband response. Also, polarization-insensitive detection as well as increased photo response in the infrared spectrum is realized under special metallic structure, 2D periodic array, and 3D optical cavity effect. Through the strong induced LSPR's, we further fabricate the Silicon based schottky photodetector that is able to detect photons well below the schottky barrier height for detection in the mid-infrared range. The detection spectral range covers from visible to over 4 UMS in wavelength.

Speaker Biography

Ching Fuh Lin obtained the B.S. from National Taiwan University in 1983, and the M.S. and PhD from Cornell University, Ithaca, NY, in 1989 and 1993, respectively all in electrical engineering. He is the founding director of Innovative Photonics Advanced Research Centre (i-PARC) and a joint distinguished professor in the Graduate Institute of Photonics and Optoelectronics, Graduate Institute of Electronics Engineering, and Department of Electrical Engineering at National Taiwan University. His major research area is in photonics, including silicon-based photonics, solar cells and applications for drones, broadband semiconductor lasers and optical amplifiers, etc. He is a fellow of IEEE, a fellow of SPIE, and member of Asia-Pacific Academy of Materials. He has published over 180 journal papers and 500 conference papers and holds more than 70 patents. He is the author of several books and obtained many awards.

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