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On-chip integrated a 3D-CMOS Si photodetector array with a fiber couplers platform for remote optical fiber monitoring

Iman Sabri Alirezaei, Joerg Vierhaus and **Edmund P Burte**
Otto-von-Guericke University of Magdeburg, Germany

A silicon-based photodetector array with on-chip integration to tiny fiber strands on a single chip is fabricated using 3D-complementary metal-oxide-semiconductor (CMOS) and microelectromechanical systems (MEMS) technology. The 3D-detector involves a vertical photoactive area as large as the fiber diameter for direct butt-coupling to the optical fiber. Novel ultra-deep trench isolation with a passivation method is carried out to overcome the leakage current as well as the surface recombination current and the dark current, which arise from the fabrication of the ultra-deep trenches. The passivation method consisting of SU-8 polymer enables to implement the deep trenches with a depth of 30μm for both the vertical photoactive area and the inter-pixel trench isolation in the CMOS process. All pixels in the linear array are held at the same applied reverse voltage, by stacking the interconnection line across the pixels. Besides, a tapered U-groove array is built on the monolithically integrated fiber couplers platform for chip-level fiber insertion. This detector shows an external quantum efficiency of 63.82%, corresponding to the photoresponsivity of 0.32A/W, at a wavelength of 631nm for 2V reverse bias. The proposed detector array integrated into a fiber bundle is very promising to apply for remote optical fiber sensing applications in harsh environments, where involve high electromagnetic fields or RF signals such as magnetic resonance imaging (MRI) or positron emission tomography (PET).

Biography

Iman Sabri Alirezaei received his MSc degree in Applied Physics from Shahid Beheshti University (SBU). He is currently doing his PhD and working as a Research Assistant in Electrical Engineering at Institute of Micro and Sensor Systems, Magdeburg University. His current research interests include CMOS-MEMS devices, micro- and nano-photonic devices, optical fiber sensors, integrated photodetectors and Lab-on-a-chip.

sabri.iman@ovgu.de

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