Session 16 - Optoelectronics, Displays, and Imagers - Image Sensors
Tuesday, December 10, 9:00 a.m.
Continental Ballroom 7-9
Co-Chairs: A. Tournier, STMicroelectronics
P. Malinowski, imec

9:05 AM **16.1** Nanophotonics Contributions to state-of-the-art CMOS Image Sensors (Invited)
Sozo Yokogawa, Sony Semiconductor Solutions Corporation

Recent progress of Back-illuminated CMOS image sensors (BI-CISs), focusing on their pixel improvements with the design of optical properties using subwavelength size scale strcutures and photonics technologies, are reviewed. These technologies contribute not only improving BI-CIS basic performance but also adding new functions for versatile sensing applications.

9:30 AM **16.2** A 0.8 µm Smart Dual Conversion Gain Pixel for 64 Megapixels CMOS Image Sensor with 12k e- Full-Well Capacitance and Low Dark Noise
Donghyuk Park, Seung-Wook Lee, Jinhwa Han, Dongyoung Jang, Heesang Kwon, Seungwon Cha, Mihye Kim, Haewon Lee, Sungho Suh, Woong Joo, Yunki Lee, Seungjoo Nah, Heegeun Jeong, Bumsuk Kim, Sangil Jung, Jesuk Lee, Yitae Kim, Chang-Rok Moon, Yongin Park, Samsung Electronics Company Ltd.

A 0.8 µm-pitch 64 megapixels CIS has been demonstrated for the first time. 6k e- full-well capacity (FWC) was achieved, and the advanced color filter isolation was introduced. Dual conversion gain enhanced the Tetracell FWC to 12k e-. Highly refined deep trench isolation and photodiode also improved dark noise characteristics.

9:55 AM **16.3** A 1/2inch 48M All PDAF CMOS Image Sensor Using 0.8µm Quad Bayer Coding 2×2OCL with 1.0lux Minimum AF Illuminance Level
Tatsuya Okawa, Susumu Ooki, Hiroaki Yamajo, Masakazu Kawada, Masayuki Tachi, Kazuhiro Goi, Takatsugu Yamasaki, Hiroki Iwashita, Masahiko Nakamizo, Takayuki Ogasahara, Yoshiaki Kitano, Keiji Tatani, Sony Semiconductor Solutions Corporation, Sony Semiconductor Manufacturing Corporation

We created the world's first all PDAF CMOS image sensor using 2x2 on-chip lens architecture. That had 1/2 inch 48M pixels with 0.8µm Quad Bayer coding for high resolution and HDR function, and all PDAF pixels achieved a minimum AF illuminance level of 1 lux.

10:20 AM **16.4** A 2.2µm Stacked Back Side Illuminated Voltage Domain Global Shutter CMOS Image Sensor
Geunsook Park, Alan Hsiung, Keiji Mabuchi, Jingming Yao, Zhiqiang Lin, Vincent Venezia, Tongtong Yu, Yu-Shen Yang, Tiejun Dai, Lindsay Grant, OmniVision Technology Inc.

This paper introduces a 2.2µm stacked BSI voltage domain global shutter CMOS image sensor displaying over 100dB shutter efficiency, as well as high NIR-QE of 38% at 940nm, 60% MTF Ny/2 at 940nm with stacked pixel level connections, high density MIM capacitors, and Full back-side Deep Trench Isolations.

11:10 AM **16.5** A Highly Reliable Back Side Illuminated Pixel Against Plasma Induced Damage
Yolene Sacchettini, Jean-Pierre Carrère, Célestin Doyen, Stéphane Ricq, Romain Duru, Vincent Goiffon, Pierre Magnan, Kristell Courouble, STMicroelectronics, University of Toulouse

Plasma process interaction with BSI image sensor is for the first time presented. The backside dielectrics properties modulate the damage, this was characterized by measuring the dielectrics charge and the

interface state density. Metal oxides present a better hardiness to plasma damage due to their negative charge even after plasma.

11:35 AM **16.6** Three-layer Stacked Color Image Sensor With 2.0-μm Pixel Size Using Organic Photoconductive Film
H. Togashi, T. Watanabe, M. Joei, T. Hayashi, S. Hirata, S. Fukuoka, Y. Ando, Y. Sato, J. Yamamoto, I. Yagi, M. Murata, M. Kuribayashi, F. Koga, T. Yamaguchi, Y. Oike, T. Ezaki, and T. Hirayama, Sony Semiconductor Solutions Corporation, Sony Corporation

A three-layer stacked color image sensor was formed using an organic film. The sensor decreases the false-color problem as it does not require demosaicing. Furthermore, with the 2.0-μm pixel image sensor, improved spectral characteristics owing to green adsorption by the organic film above the red/blue photodiode, were successfully demonstrated.

12:00 PM **16.7** High-definition Visible-SWIR InGaAs Image Sensor using Cu-Cu Bonding of III-V to Silicon Wafer
S. Manda, R. Matsumoto, S. Saito, S. Maruyama, H. Minari, T. Hirano, T. Takachi, N. Fujii, Y. Yamamoto, Y. Zaizen, T. Hirano, and H. Iwamoto, Sony Corporation

We developed a back-illuminated InGaAs image sensor with 1280 x 1040 pixels at 5-um pitch by using Cu-Cu hybridization connecting different materials, a III-V InGaAs/InP of photodiode array, and a silicon readout integrated circuit (ROIC). A prototype device showed high sensitivity at visible to SWIR wavelengths and low dark current.