Session 18 - Sensors, MEMS and Bioelectronics - Biomedical Sensors and Neural Interfaces
Tuesday, December 10, 9:00 a.m.
Imperial Ballroom B
Co-Chairs: G. Xu, University of Massachusetts, Amherst
S. Zafar, IBM T.J. Watson Research Center

9:05 AM **18.1** Minimally Invasive Medical Catheter with Highly Flexible FDSOI-based Integrated Circuits
Seung-Yoon Kim, Jae Hoon Bong, Mi Kyung Kim, Wansik Hwang, Hyunjoo Lee, Byeong-Wook Song, Il-Kwon Kim, Byung Jin Cho, KAIST, Korea Aerospace University, International St. Mary's Hospital, Catholic Kwandong University

A highly flexible integrated circuit (IC) composed of sensors and amplifiers using high-performance fully depleted silicon-on-insulator (FDSOI) transistors is demonstrated for bio-medical applications. A catheter with a 1 mm diameter, equipped with this flexible IC, is fabricated and successfully demonstrated for minimally invasive medical instrument applications with good bio-compatibility.

9:30 AM **18.2** Highly Sensitive Silicon Slip Sensing Imager for Forceps Grippers Used under Low Friction Condition
Kanako Ando, Takafumi Yamamoto, Yusaku Maeda, Kyohei Terao, Fusao Shimokawa, Masao Fujiwara, Hidekuni Takao, Kagawa University, Takamatsu Red Cross Hospital, JST-CREST

We are reporting the first silicon electron device for the realization of detection in slip of grasping by laparoscopic forceps under very low friction condition. Even under "zero-level" friction, slip of grasping object is detectable with the original algorithm inspired from the finger's sense of slip.

9:55 AM **18.3** Neural Interfaces Based on Flexible Graphene Transistors: A New Tool for Electrophysiology (Invited)
Anton Guimerà-Brunet, Eduard Masvidal-Codina, Xavi Illa, Miguel Dasilva, Andrea Bonaccini-Calia, Elisabet Prats-Alfonso, Javier Martínez-Aguilar, Jose De la Cruz, Ramon Garcia-Cortadella, Nathan Schaefer, Almudena Barbero, Philippe Godignon, Gemma Rius, E. Del Coro, J. Bousquet, C. Hébert, Rob Wykes, Maria V. Sanchez-Vives, Rosa Villa, J.Garrido, IMB-CNM (CSIC), Institut de Microelectrònica de Barcelona, IMB-CNM, CIBER-BBN, IDIBAPS, ICN2, BIST, University College London, ICREA

The use of graphene transistors for transducing neural activity has demonstrated the potential to extend the spatiotemporal resolution of electrophysiological methods to lower frequencies, providing a new tool to understand the role of the infra-slow activity.

10:20 AM **18.4** Design and Fabrication of CMOS-based Neural Probes for Large-scale Electrophysiology (Invited)
Carolina Mora Lopez, Alexandru Andrei, Shiwei Wang, Rita Van Hoof, Simone Severi, Nick Van Helleputte, imec

This paper describes the design and fabrication of the CMOS-based Neuropixels neural probe, which integrates a high-density micro-electrode array and a high channel count to enable large-scale electrophysiology in small rodents. Miniaturization and scalability aspects are also discussed here.

10:45 AM COFFEE BREAK

11:10 AM **18.5** Solution Processed Highly Uniform and Reliable Low Voltage Organic FETs and Facile Packaging for Handheld Multi-ion Sensing
Yukun Huang, Yawen Song, Yixiao Tang, Zhe Liu, Lei Han, Qiuqi Zhang, Bang Ouyang, W. Tang, Linrun Feng, Xiaojun Guo, Shanghai Jiao Tong University, Wuhan LinkZill Technology Co., Ltd.

Organic FETs are fabricated over large area via high throughput coating, and present steep subthreshold, large ON/Off ratio, excellent uniformity and operational stability in all regimes. With a facile packaging approach to connect the device to external test environment, a handheld battery-powered multi-ion sensing system is demonstrated.

11:35 AM **18.6** BioFET Technology: Aggressively Scaled pMOS FinFET as Biosensor
Koen Martens, Sybren Santermans, Mihir Gupta, Geert Hellings, Robin Wuytens, Bert Du Bois, Emmanuel Dupuy, Efrain Altamirano-Sanchez, Karolien Jans, Rita Vos, Tim Stakenborg, Liesbet Lagae, Marc Heyns, Simone Severi, Wim Van Roy, imec, KU Leuven

We report for the first time on a BioFET sensor using 10nm wide FinFETs built in a 300 mm pilot line. Median voltage referred 1/f noise is only ~500 $\mu V^2 \mu m^2 Hz$ (@1Hz). pH sensitivity for HfO_2 is near the Nernstian limit. Biomolecular transduction is demonstrated for DNA grafting and PNA-DNA hybridization.

12:00 PM **18.7** Nanopore Digital Counting of Amplicons for Ultrasensitive Electronic DNA Detection
Zifan Tang, Gihoon Choi, Reza Nouri, Weihua Guan, Pennsylvania State University

We demonstrate the feasibility of using the single molecule sensing nanopore as a digital counter to enumerate the amplicons for ultrasensitive electronic nucleic acid analysis. The nanopore digital counting approach could capture the DNA replication dynamics and could be used in a qualitative test and in a quantitative test.