## Manufacturing Science and Technology Group
## Room 202B - Session MS+MN-TuA

## IoT Session: Challenges of Sensor Manufacturing for the IoT

**Moderator:** Robert Lad, University of Maine

2:20pm **MS+MN-TuA-1 Manufacturing Strategies for Flexible Hybrid Electronics***, **Scott Miller**,* NextFlex **INVITED**

Flexible Hybrid Electronics (FHE) combines technologies and manufacturing capabilities from the worlds of printing and additive manufacturing; flexible, bendable, stretchable, and 3D substrates; and conventional silicon integrated circuits to bring novel form and function to high-performing electronic devices. The US manufacturing ecosystem for FHE is rapidly growing and applications of FHE devices are being advanced in areas as diverse, and yet overlapping, as human health and performance monitoring, antennas and wireless communications, soft robotics, structural health management, and IoT. A single device build can require solving substrate challenges, printing functional conductors, resistors, and dielectrics, placing discrete passives, attaching bare-die integrated circuits using conductive adhesives, integrating a power supply, and encapsulating the entire device. As a Manufacturing Institute, NextFlex works with its members on technologies that have passed the applied research stage to advance their readiness for manufacturing and position them for product development. This talk will explore challenges and opportunities in FHE, including translating designs to manufacturing, material and device characterization, availability of material and process data, and scaling processes to high-rate manufacturing. Approaches to address these challenges will be discussed and example projects related to IoT will be presented.

3:00pm **MS+MN-TuA-3 Enabling Smart and Connected Living through High Volume Roll to Roll Manufacturing***, **Enid Kivuti**,* Sheldahl Flexible Technologies **INVITED**

Enabling Smart and Connected Living through High Volume Roll to Roll Manufacturing

The presentation will provide an overview of automated, continuous processing technologies available in the manufacture of Flexible Printed Electronics for the Internet of Things applications. Beginning with material choice, and concluding with proposed useable devices, we will explore Additive, Subtractive and Hybrid technologies and the governing design rules. We will review recent industry developments that enable finished products to improve user experience. Finally, we will provide examples of scalable IOT applications that meld the use of existing capital assets with the rapidly evolving industry options to deliver improved performance at a lower total cost of ownership.

Key Words:

Thin Film Vacuum Deposition

Printed Electronics

Hybrid Technology

Sensors

Medical

Automotive

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4:20pm **MS+MN-TuA-7 New Generation Chemical and Biological Sensors: From New Ideas to Manufacturable Products in the era of Internet of Things and Industrial Internet***, **Radislav Potyrailo**,* General Electric Global Research Center **INVITED**

Modern monitoring requirements of gases and liquids for demanding applications such as medical diagnostics, environmental surveillance, biopharmaceutical process control, industrial safety, and homeland security push the limits of existing detection concepts where we may reach their fundamental performance limits. Thus, without violating the laws of physics, chemistry, and electronics, we need to develop new practical detection concepts and instruments. We are developing new generation of handheld, wireless, and wearable sensors that bridge the gap between the existing and required sensing capabilities. This talk will stimulate your scientific and engineering senses by posing several fundamental and practical questions on principles of chem/bio sensing and by demonstrating on how we address these questions in the developments of sensors with previously unavailable capabilities with examples of strategies of bringing new ideas from their initial lab tests, to field validation, and to final products.

5:00pm **MS+MN-TuA-9 The Unique Challenges Implantable Sensor Manufacture***, **Kimberly Chaffin**, S Terry,* Medtronic plc **INVITED**

Sensors onboard today's implantable medical devices monitor the critically ill and trigger the delivery of life sustaining and saving therapies. As medicine moves from retrospective treatment to predict and prevent, a transition enabled, in part, by the Internet of Things (IoT), sensors will no longer only be operational in the critically ill, but in all of us. In the future, sensors will have the sole purpose of measuring physiological signs and providing patient centric feedback to prevent future events. Setting aside the psychological challenges of receiving a long-term implant for prevention, this transition to prevent and predict is making the medical device industry rethink sensor manufacture, where the device-biological interface is one of several critical factors. The current design paradigm of isolating implantable device circuitry from the biological environment in hermetic titanium cans, largely limiting the signal to electrical feedthroughs, must shift to allow for new sensor modalities. Chemical sensors must detect biomarkers unhindered by the immune response that accompanies every implant. Optical sensors must 'see' into the body. Pressure sensors must employ sensitive diaphragms where the internal device pressure must remain constant and the fibrotic capsule formation associated with the immune response must not dampen sensitivity. In this talk, we will review the critical manufacturing technologies being developed for implantable sensors that predict and prevent.

# Author Index

## Bold page numbers indicate presenter