IEEE Mini-Colloquium on Large Area Electronics

Friday, November 6, 2009

7.30AM – 6 PMEIT 3142

Agenda

7.30 Light breakfast (provided for all participants)

8.00 Opening remarks

8.15 Distinguished Lecture #1: Lu Kasprzak, "Digital Radiography"

9.15 Invited Lecture #1: Safa Kasap "Progress in Science and Technology of Direct Conversion X-Ray Image Detectors: Competing Photoconductors and Selenium"

10.00 Coffee break(provided for all participants)

10.15 Distinguished Lecture #2: Yue Kuo "ULSI vs. TFT"

11.15 Distinguished Lecture #3: Ashraf Alam "The Physics and Technology of Nanonet Electronics"

12.15 Lunch(not provided)

2.15 Distinguished Lecture #4: Durga Misra "Breakdown of TiN/High-k Gate Stacks in Nanoscale CMOS"

3.15 Invited Lecture #2: Aldo Badano "Challenges and opportunities in modeling imaging detectors"

4.00 Coffee break (provided for all participants)

4.15 Invited Lecture #3: John Rowlands "X-ray light valve"

5.00 Closing remarks

5.15 G2N lab tour (please indicate if you would like to tour in your rsvp)

6.00 Adjourn

Space is limited. To ensure seating,

please RSVP by October 28th to: Professor K.S. Karim, kkarim@uwaterloo.ca

Distinguished Lecture #1:Digital Radiography by Lu Kasprzak

Digital Radiography has become pervasive in the past 10 years. Image capture technologies and their applications will be reviewed, with a focus on TFT technology, fill factor, MTF, DQE, FPN and materials used.

Distinguished Lecture #2: ULSI vs. TFT by Yue Kuo

The sales of IC and TFT LCD products reached near US $300B and $80B, separately, recently. Currently, the state-of-the-art wafer size of IC is12-inch while that of the TFT mother glass is great than 2 m by 2m. Themass production history of IC is 50 years while that of the large-size TFTarray is 20 years. Therefore, both are highly successful industries.Recently, there are many new developments in the TFT technology that canbroaden applications to beyond pixel driving but without losing thelarge-area fabrication capability. Furthermore, the new copper interconnecttechnology has been developed for both TFT and IC products. This is a goodtime to examine these two technologies and to explore their possible futuredevelopments. The speaker will analyze similarities and differences of thesetechnologies and show examples on how they can learn from each other'sexperience and collaborate in developing future products.

Distinguished Lecture #3: The Physics and Technology of Nanonet Electronics by Muhammad A. Alam

As the future of Moore’s law of transistor scaling appears uncertain, Electronics is trying to reinvent itself by broadening its focus to other areas including macroelectronics (electronics of large, possibly flexible and transparent displays), bioelectronics (e.g., nanobio sensors for geomomics, proteomics), and energy-harvesting (e.g., solar cells). In this regard, a material based on nanonets of Carbon Nanotubes or Si/ZnO/SiGe Nanowires have attracted considerable attention. The nanonets act as channel materials for thin-film transistors for flexible/transparent electronics, as sensor elements for label-free bio-sensors, and as transparent top electrode for solar cells. The performance of these Nanonet devices have been good (and sometimes impressive) and various laboratories have reported considerable improvements over the years. A lack of predictive transport models, however, has stymied the translation of laboratory experiments to practical, disruptive technology. The classical theory of bulk semiconductors, developed over last 50 years in close collaboration with experimentalists, device physicists, numerical analysts, and computer scientists, does no longer apply to these new electronic components with spatially inhomogeneous transport properties. In this talk, I will discuss a simple theory of the Nanonets based on 2D percolation and fractal dynamics to show how these simple/intuitive views is challenging conventional wisdom and allowing optimization of nanonet transistors, biosensors, and solar-cells.

Distinguished Lecture #4: Breakdown of TiN/High-k Gate Stacks in Nanoscale CMOS by Durga Misra

Stringent power requirements in the chips by the International Technology Roadmap for Semiconductors (ITRS) dictate replacement of silicon dioxide as it has already reached the direct tunneling regime. Therefore, for high speed and low power applications high-k dielectric materials are being integrated into standard CMOS technologies. At present, reliability requirements of advanced gate stacks with high-k dielectrics are of intensive research interests as these high-k dielectrics needs to meet the silicon dioxide standards. In this talk some of the inherent asymmetry on breakdown characteristics of interfacial layer (IL) and high-κ layer in the overall gate stacks breakdown will be discussed. Gate stack's response to many degradation mechanisms such as charge trapping and defect generation, soft breakdown, progressive breakdown and finally hard breakdown will be evaluated as a function of ILs, grown on various process conditions. Correlation of stress-induced leakage current (SILC) with the breakdown behavior will be outlined.

Invited Lecture #1: Progress in Science and Technology of Direct Conversion X-Ray Image Detectors: Competing Photoconductors and Seleniumby Safa Kasap

Recently commercialized flat panel direct conversion x-ray mage detectors have been shown to provide high resolution x-ray imaging in which the resolution is limited by the underlying pixel size. The high resolution arises from the use of an x-ray photoconductor to convert the absorbed x-ray radiation directly to charge carriers. The key component of such an image detector is obviously the photoconductor. This talk reviews the past and present advances in x-ray photoconductors that enabled the eventual commercial production of the flat panel x-ray image detectors for medical imaging. A particular attention is paid to "selenium", a curious semiconducting material that played an important and unusual role not only in early electrical engineering but in a number of diverse engineering applications, even today. The most important application of selenium is its use as a photoconductor in high resolution direct conversion x-ray imagers. One of the ultrasensitive modern video camera at NHK uses a photoconductive target based on avalanche multiplication in amorphous selenium - it can capture images even under candle light.

Invited Lecture #2: by Aldo Badano (FDA)Challenges and opportunities in modeling imaging detectors

Thecapability to simulate the imaging performance of new detector designsis crucial to develop the next generation of medical imaging systems.Proper modeling tools allow for optimal designs that maximize imagequality while minimizing patient and occupational radiation doses. Inthis talk, I will review current progress and challenges in thesimulation of imaging detectors with a focus on indirect columnarscintillator structures and on validation strategies.

Invited Lecture #3: by John Rowlands (Thunder Bay Regional Research Institute) X-ray Light Valve