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Western Australia Section

Joint Chapter ESP:
Electron Devices Society
Solid State Circuits Society
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Advancement of Materials and Device Technology Based on Wide Band Gap Semiconductors

A Seminar of the IEEE WA joint EDS/SSCS/IPS Chapter

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Venue: **Billings Room 3.04, 3rd floor. Electrical & Electronic Engineering Building**
University of Western Australia, Crawley

This seminar is open to the public and admission is free to all IEEE members and non-members

Abstract:

Keeping in pace with the advent of technology in Electrical and Electronics (E&E) sector nowadays, green technology is deemed to be important towards the sustainable development of a nation. Considerable interest has been devoted to utilizing wide band gap semiconductors, which have emerged as the promising materials in energy efficient solid-state lighting and applications beyond solid-state lighting, such as photodetectors and gas sensors. Gallium nitride (GaN) and its alloys have long been the materials-of-choice for the fabrication of heterostructures to produce high quality desired emission wavelength of ultraviolet/blue/green light emitting diodes (LEDs). Alternatively, zinc oxide (ZnO) with similar characteristics relative to GaN has been also investigated as the next generation material for low cost LEDs. Low cost chemical bath deposition and hydrothermal methods were studied to produce the heterostructures of ZnO on GaN for the development of hybrid LEDs. Innovations in solid-state lighting have been researched via the fabrication of blue LEDs and ultraviolet LEDs using ZnO and doped ZnO nanorods grown on GaN, respectively. Related research with regard to producing high quality phosphor material via novel synthesis method for white light generation as well as studying surface alteration of GaN substrate, aiming to produce pores or nanostructures on GaN surface, potentially used as growth template for LEDs have been also carried out. An advancement of technology by shifting to using porous ternary and quaternary alloys has also been initiated, having known that such features could be intentionally engineered to exhibit unique chemical and physical properties that would provide larger surface-to-volume ratio as compared to their bulk counterparts, opening possibilities for potential applications in photodetection and hydrogen gas sensing. Enhancement in light extraction of LEDs was also investigated via some studies of transparent conducting oxide (TCO). In recent times, two emerging technologies: "GaN on GaN" LED and laser-based lighting have accelerated the growth of LED industry for the next generation solid-state lighting. “GaN on GaN” technology is also now being pursued for the niche market of UV LEDs and LiFi. Advanced epitaxy technology of fabricating GaN-based LEDs using metal-organic chemical vapor deposition (MOCVD) was successfully accomplished. InGaN/GaN LEDs were fabricated on patterned sapphire substrates (PSS) and bulk GaN substrates through a five-year technology transfer program from University of California, Santa Barbara (UCSB) to Malaysia under a project funded by Malaysian government for 5 years through Economic Planning Unit for a total funding of RM 75 million. The goal is to produce high efficiency and high lumen Malaysian made white LEDs which involves scientific collaboration with academia and industry in Malaysia.

Biography:

Professor Dr Zainuriah Hassan is an expert in the area of wide band gap semiconductors and devices. She started her early education at Father Barre's Convent Primary School, and completed her secondary education at Sultanah Asma Secondary School in 1978. In 1979, she was awarded the Gold Medal by the Sultan of Kedah for best performance in the Malaysia Certificate of Education examination. She then received a scholarship from the Ministry of Education of Malaysia to pursue her undergraduate and Master level studies in the United States, and received the B.Sc (Magna Cum Laude) degree and the Masters degree in Physics from Western Michigan University, USA in 1983 and 1985, respectively. In 1994, she was awarded a fellowship under the Academic Staff Training Scheme from Universiti Sains Malaysia to pursue her Ph.D studies. She received the Ph.D degree in Experimental Condensed Matter Physics from Ohio University, USA in 1998, and was a Research Associate there from 1997 to 1998. She started her work as a Lecturer at School of Physics, Universiti Sains Malaysia in September 1998.

At present, Professor Dr. Zainuriah Hassan is attached to the Institute of Nano Optolectronics Research and Technology (INOR), at Universiti Sains Malaysia. She was formerly the Director of the Centre for Research Initiatives in Natural Sciences (2013-2015), Dean (2010-2012), Deputy Dean-Academic and Student Development (2009-2010), and Chair of the Engineering Physics Program (2007-2009) at the School of Physics, Universiti Sains Malaysia. She was a Visiting Research Scholar under the Fulbright Program at the Department of Electrical and Computer Engineering, University of Minnesota, USA in 2004/2005.

Professor Dr Zainuriah has been a pioneer researcher in Malaysia on work related to GaN-based (III-nitrides) materials and devices. She has made an outstanding contribution in starting the work on these areas which have very important applications as optoelectronic devices such as light emitting diodes (LEDs) for environmentally friendly and energy efficient solid-state lighting. Her team has established a research laboratory that is now a renowned centre of excellence in the region called Institute of Nano Optoelectronics Research and Technology –INOR.

Her focus of research is on all aspects related to materials growth, characterization, and fabrication of optoelectronic and electronic devices such as LEDs and sensors based on III-nitrides (GaN, InN, AlN, and related nitride alloys) and also other wide band gap semiconductors such as ZnO, CdS, TiO2, CdO and other metal oxides. She is also working on organic materials for light emitting device applications. She was the Project Leader for a research grant worth RM 11,299,914.00 (~ US$ 3 million) entitled "Material (III-V Nitrides and Organic Layers) Fabrication and Characterization" awarded by MOSTI (Ministry of Science, Technology and Innovation) under the IRPA RMK8 Strategic Research (2002 - 2006). She was also the main and co-researcher for 60 other national and international research grants. She is currently the Project Leader for a Long-Term Research Grant Scheme (LRGS) worth RM 2 million entitled "Wide Band Gap Semiconductors - Energy Efficient Lighting" awarded by the Ministry of Education, and involved in the national project entitled "GaN on GaN", which is funded by Malaysian government for five years (2015-2020) through Economic Planning Unit (EPU) for a total funding of RM 75 million. The ultimate target of the "GaN on GaN" program is to produce high luminaire LEDs up to 250 Lm/W for 2" and 4" LED chips in Malaysia for the first time.

Professor Dr Zainuriah's research findings have been published in various prestigious international and national journals. Her more than 700 papers have been highly cited and her current h-index is 29 and was recognised as one of the 2013 Top Research Scientists Malaysia (TRSM). She has been featured on Thomson Reuters homepage (SCIENCE@MALAYSIA) as one of the Accomplished USM Researchers on ResearcherID. She has supervised more than 80 PhD and MSc students. She has received several national and international awards and scholarships, and served as reviewer, editor, jury, and member of various evaluation panels. She also served on various committees, providing services for the community and country, and was a member of the Ibn Al-Haytham International Working Group for the International Year of Light IYL 2015 (under UNESCO). She is currently a Fellow of Academy of Sciences Malaysia, and a member of the Materials Research Society, Optical Society of America, IEEE, Fulbright Association, Malaysian Solid State Science and Technology Society, and Malaysian Institute of Physics.