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応用物理学会北海道支部講演会のお知らせ

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【 演題 】 III-V Nanostructures for Optoelectronic Device and Energy Applications
【 講師 】 Hoe Tan
Professor, ARC Centre of Excellence for Transformative Meta-Optical Systems
Department of Electronic Materials Engineering, Research School of Physics　The Australian National University
【 日時 】 7 月 19 日（水）15:00 〜 16:00
【 講演開催場所 】 北海道大学量子集積エレクトロニクス研究センター 304 セミナー室
【 主催 】 応用物理学会北海道支部
【 講演の要旨 】 Group III-V semiconductors have revolutionised electronics and optoelectronics due to their superior physical and optoelectronic properties including high carrier mobility, direct bandgap and band structure engineering capability. Reducing the device size to nanoscale brings many unique properties, such as large surface-area-to-volume ratio, high aspect ratio, carriers and photons confinement effect. In this talk I will present our III-V research activities at The Australian National University, focusing on (i) nanowires, (ii) shape engineering, (iii) hexagonal boron nitride and (iv) thin film technology.

(i) Nanowires are usually grown by the so-called vapour-liquid-solid growth mechanism or the selective area growth techniques. Device applications of these nanowires such as lasers, solar cells and photoelectrodes for hydrogen production will be presented.

(ii) Our work on selective area growth of III-V nanostructures shows the possibility of obtaining other functional nanostructures beyond the limitation of rod-like nanowires and opening the way to more advanced device geometries, such as nanomembranes and micro-rings. Our micro-ring lasers have excellent cavity due to the atomically flat facets and operate in the whispering gallery mode. They are important components for integrated photonics applications as light from can these devices can be efficiently coupled to on-chip waveguides.

(iii) Hexagonal boron nitride (hBN) is a two-dimensional, wide-bandgap semiconductor which is well-known for its thermal and chemical stability, passivation properties and, more recently, as single photon emitters which has applications in quantum computing and cryptography. However, hBN is currently limited to 1-2 mm in size, which is impractical in real applications. I will introduce our work on growing wafer-scale hBN for applications as single photon sources and templates for van der Waals epitaxy.

(iv) Thin film technology based on epitaxial lift-off and spalling techniques are attractive to reduce the cost of III-V devices and to make flexible devices. Our research focus on multilayer epitaxial lift-off and the integration with earth abundant catalysts for green hydrogen generation.

Bio:
Prof. Tan received his B.E. (Hons) in Electrical Engineering from the University of Melbourne in 1992 and PhD in Materials Engineering from the Australian National University in 1997. He has co-authored over 570 journal papers and 9 book chapters, with over 21,000 citations and a h-index of 70. He is also a co-inventor in 6 US and 2 Australian patents related to laser diodes, infrared photodetectors, photonic devices and catalysis. Prof. Tan is a Fellow of the IEEE “for contributions to compound semiconductor optoelectronic materials and devices”. He was also the Distinguished Lecturer for IEEE Nanotechnology Council (2016 & 2017) and IEEE Photonics Society (2016-2017). He was named “Australia’s leading researcher in nanotechnology” by The Australian’s research magazine in 2020. Prof. Tan is the director of the $30M Australian National Fabrication Facility - ACT Node, which provides micro/nano-fabrication facilities for the R&
D communities. He is currently the Associate Director for Infrastructure at the Research School of Physics, ANU.

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