UKNC Conference Programme

STRATHCLYDE 2024

University of Strathclyde

10th-11th January 2024

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Any participants who have concerns that the Code of Conduct has been breached should contact one of the UKNC committee members responsible for conferences:

Prof David Binks: david.binks@manchester.ac.uk

Dr Fabien Massabuau: f.massabuau@strath.ac.uk

Prof Rachel Oliver: rao28@cam.ac.uk

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Wednesday 10th of January 2024.

09:30-10:25 Arrival, Registration and Coffee

10:25-10:30 Opening Remarks

10:30-11.15 Foxon Lecture - Chair: Rob Martin

Porous GaN

Prof Rachel Oliver

University of Cambridge, UK

11.15-12.30 Session 1: Characterisation- Chair: Rob Martin

11.15-11.30 **Holistic characterization of III/N and III/V nanowires using experimental big data**

Stephen Church[1], Aswani Vilasam[2], Nikita Gagrani[2], Hoe Tan[2], Chennupati Jagadish[2], Yunyan Zhang[3], Huiyun Liu[4], Francesco Vitale[5], Daniel Repp[5], Carsten Ronning[5], Nian Jiang[6], Hannah Joyce[6] and Patrick Parkinson[1]

[1] University of Manchester, UK

[2] Australian National University, Canberra, Australia

[3] Zhejiang University, Hangzhou, China

[4] University College London, UK

[5] Friedrich-Schiller-University of Jena, Jena, Germany

[6] University of Cambridge, UK

11.30-11.45 **Effect of indium content on the optical properties of zincblende InGaN/GaN quantum wells**

D. Dyer,[1] M. J. Kappers,[2] D. J. Wallis,[2,3] R. A. Oliver,[2] and D. J. Binks[1]

[1]Department of Physics and Astronomy & Photon Science Institute, University of Manchester, UK

[2]Department of Materials Science and Metallurgy, University of Cambridge, UK

[3]Centre for High Frequency Engineering, Cardiff University, UK

11.45-12.00 **Misorientation and Strain Associated with Threading Dislocations in GaN using Electron Backscatter Diffraction**

K. P. Hiller[1], A. Winkelmann[1, 2], B. Hourahine[1] , P. J. Parbrook[3] , G. Cios[2] , C. Trager-Cowan[1], and J. Bruckbauer[1]

[1]Advanced Materials Diffraction Lab, Department of Physics, SUPA, University of Strathclyde, UK

[2]Academic Centre for Materials and Nanotechnology, AGH University of Krakow, Poland

[3]Tyndall National Institute, University College Cork, Ireland

12.00-12.15 **Temperature and excitation dependence of recombination efficiency in cubic InGaN/GaN Quantum Wells**

W. R. Fieldhouse-Allen[1], M. J. Kappers[2], M. Frentrup[2], D. J. Wallis[2,3], R. A. Oliver[2] and D. J. Binks[1]

[1]Department of Physics and Astronomy, University, of Manchester, UK

[2]Department of Materials Science & Metallurgy, University of Cambridge, UK
[3] Centre for High Frequency Engineering, University of Cardiff, UK

12.15-12.30 **Deep level defects in dilute $Al_xGa_{1-x}N$ alloy**

L.J. Sun[1*], P. Kruszewski[2], V.P. Markevich[1], A.R. Peaker[1], I.F. Crowe[1], J. Plesiewicz[2], P. Prystawko[2], D. Binks[3], and M.P. Halsall[1]
[1]Photon Science Institute and Department of Electrical and Electronic Engineering, The University of Manchester, UK
[2]Institute of High-Pressure Physics, Polish Academy of Sciences, Poland
[3]Dept. of Physics and Astronomy & Photon Science Institute, University of Manchester, UK

12.30-13.30 Lunch *sponsored by Attolight*

13.30-14.15 The Humphreys Lecture- Chair: Fabien Massabuau

Development of β-Ga_2O_3 for High Voltage Power Electron Devices

Prof Jim Speck
University of California Santa Barbara, USA

14.15-15.30 Session 2: Gallium Oxide- Chair: Fabien Massabuau

14.15-14.30 **β-Ga_2O_3 trench Schottky barrier diodes for high voltage applications**

Vanjari Sai Charan[1], Aditya Bhat Kundapura[1], Indraneel Sanyal[1], Yuke Cao[1], Matthew Smith[1], and Martin Kuball[1]
[1]Center for Device Thermography and Reliability, HH Wills Physics Laboratory, University of Bristol, UK

14.30-14.45 **Cathodoluminescence study of dislocations in ELOG α-Ga_2O_3**

M. Maruzane[1], Y. Oshima[2], O. Makydonska[1], P. R. Edwards[1], R.W. Martin[1], and F.C-P Massabuau[1]
[1] Department of Physics, SUPA, University of Strathclyde, UK
[2] National Institute for Materials Science, Tsukuba, Japan

14.45-15.00 **Deep level traps in epi-layers of (010) β-Ga_2O_3 grown by metal organic chemical vapour deposition on Sn-doped β-Ga_2O_3 substrates**

C. A. Dawe[1], V. P. Markevich[1], M. P. Halsall[1], I. D. Hawkins[1], A. R. Peaker[1], D. Binks[2], A. Nandi[3], I. Sanyal[3] and M. Kuball[3]
[1] Photon Science Institute and Department of Electrical and Electronic Engineering, The University of Manchester, UK
[2] Photon Science Institute and Department of Physics and Astronomy, The University of Manchester, UK
[3] Center for Device Thermography and Reliability, University of Bristol, UK

15.00 -15.15 **Comparative study of the optical properties of α-, β-, and κ-Ga_2O_3**

L. Penman,[1] Z. Johnston,[1] Y. Oshima,[2] C. McAleese,[3] P. Mazzolini,[4,5] M. Bosi,[5] L. Seravalli,[5] R. Fornari,[4,5], and F. Massabuau[1]
[1] Department of Physics, University of Strathclyde, UK
[2] National Institute for Materials Science, Japan

[3] *AIXTRON Ltd., Cambridge, UK*
[4] *Department of Mathematical, Physical and Computer Sciences, University of Parma, Italy*
[5] *IMEM-CNR, Parma, Italy*

15.15 -15.30 **Heteroepitaxy of β-Ga_2O_3 on 4H-SiC via Metal Organic Chemical Vapor Deposition**
Indraneel Sanyal, Arpit Nandi, David Cherns, and Martin Kuball
Center for Device Thermography and Reliability, University of Bristol, UK

15.30-16.00 Coffee *sponsored by Zeiss*

16.00-17.00 Session 3: Growth and Emerging Materials- Chair: David Binks

16.00 -16.15 **MOCVD overgrowth of µ-honeycomb AlGaN structures**
Sandeep M. Singh[1, 2*], Vitaly Zubialevich[1], and Peter J. Parbrook[1, 2]
[1] *Tyndall National Institute, University College Cork, Ireland*
[2] *Electrical and Electronic Engineering, School of Engineering, University College Cork, Ireland*

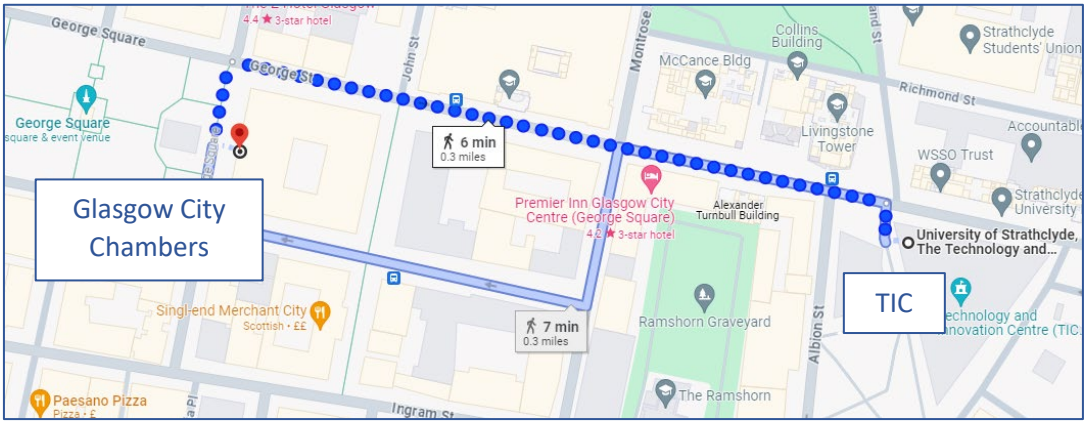
16.15 -16.30 **High-temperature molecular beam epitaxy of hexagonal boron nitride and hBN-graphene lateral heterostructures.**
T.S. Cheng[1], J. Bradford[1], T.S.S. James[1], C.J. Mellor[1], K. Watanabe[2], T. Taniguchi[2], I. Aharonovich[3], L.F. Zagonel[4], B. Gil[5], G. Cassabois[5], P.H. Beton[1], and S.V. Novikov[1]
[1]*School of Physics and Astronomy, University of Nottingham, UK*
[2]*National Institute for Materials Science, Japan*
[3]*School of Mathematical and Physical Sciences, University of Technology Sydney, Australia*
[4]*Institute of Physics, University of Campinas, Brazil*
[5]*Laboratoire Charles Coulomb, CNRS-Université de Montpellier, France*

16.30 -16.45 **Morphological, structural and strain relaxation properties of porous InGaN-based pseudo-substrate for long wavelength µ-LEDs**
Yihong Ji[1], Martin Frentrup[1], Xiaotian Zhang[1], Jakub Pongrácz[1,2,3], Simon M. Fairclough[1], Yingjun Liu[4], Tongtong Zhu[4], and Rachel A. Oliver[1,4]
[1]*University of Cambridge, UK*
[2]*Czech Academy of Science, Czech Republic*
[3]*Brno University of Technology, Czech Republic*
[4]*Poro Technologies Ltd, UK*

16.45 -17.00 **Inductively-coupled plasma etching of aluminium nitride structures for next-generation quantum technology applications**
H. Bilge Yağcı[1,2] Sam G. Bishop[1,2], Joseph K. Cannon[1,2] , John P. Hadden[1,2], Anthony J. Bennett[1,2]
[1]*School of Engineering, Cardiff University, UK*
[2]*Translational Research Hub, Cardiff University, UK*

17.00 AGM

19.00 Drinks Reception & Conference Dinner *sponsored by AIXTRON*
At City Chambers



Thursday 11th of January 2024.

09.00-09.45 Invited Talk- Chair: Rachel Oliver

Scandium Aluminium Nitride
Prof Dr. Oliver Ambacher
Albert-Ludwigs-Universität Freiburg, Germany

09.45-11.00 Session 4: Electrical Devices- Chair: Rachel Oliver

09.45 -10.00 **Nanoscale mapping of threshold voltage distribution in GaN-based high electron mobility transistor structures**
C. Chen[1], S. Ghosh[1], P. De Wolf[2], F. Adams[1], M. J. Kappers[1], D. J. Wallis[1, 3], and R. A. Oliver[1]
[1] Department of Materials Science and Metallurgy, University of Cambridge, UK
[2] Bruker Nano Surfaces, California, USA
[3] Centre for High Frequency Engineering, University of Cardiff, UK

10.00 -10.15 **Electric field distribution in quasi vertical diodes by second harmonic generation**
Anjali Anjali[1], Yuke Cao[1], James Pomeroy[1], Eldad Bahat Treidel[2], Enrico Brusaterra[2], Mihaela Wolf[2], Oliver Hilt[2], and Martin Kuball[1]
[1] Center for Device Thermography and Reliability, H.H. Wills Physics Laboratory, University of Bristol, UK
[2] Ferdinand-Braun-Institut (FBH), Germany

10.15 -10.30 ***An ab initio study of electron transport in ultra-wide band gap semiconductors***
Patrick Williams, Angela Dyson, and Patrick Briddon
Newcastle University, UK

10.30 -10.45 **A Modelling study of carriers transport in GaN/AlGaN superlattices using Monte Carlo simulation**
Mengxun Bai and Judy Rorison
Electrical and Electronic Engineering, University of Bristol, Bristol, UK

10.45 -11.00 **Temperature-Dependent Dynamic On-Resistance of Normally-Off GaN HEMTs**
Francesca Adams[1], Suzanne Lo[2], Charley Shi[2], Aaron Wadsworth[2], Saptarsi Ghosh[1], Matthew G. S. Pearce[2], David J. Wallis[1,3], Duleepa J. Thrimawithana[2], Rachel A. Oliver[1]
[1] Dept of Materials Science and Metallurgy, University of Cambridge, UK
[2] Dept of Electrical, Computer and Software Engineering, University of Auckland, New Zealand
[3] Centre for High Frequency Engineering, University of Cardiff, UK

11.00-11.30 Coffee break *sponsored by CSA Catapult*

11:30-12:15 Session 5: Visible Emitters Chair: Peter Parbrook

11.30 -11.45 **Saturation of localisation centres and efficiency droop in InGaN/GaN quantum wells**
R. M. Barrett[1], D. Dyer[1], J. M. McMahon[2], S. Schulz[2], M. J. Kappers[3], R. A. Oliver[3], and D. Binks[1,]*
[1] Dept. of Physics & Astronomy & Photon Science Institute, University of Manchester, UK
[2] School of Physics & Tyndall National Institute, University College Cork, Ireland
[3] Department of Materials & Metallurgy, University of Cambridge, UK

11.45 -12.00 **Gallium nitride hybrid photonic integration – challenges and applications**
Jack A Smith[1], Saptarsi Ghosh[2], Benoit Guilhabert[1], Rachel A Oliver[2], and Michael J Strain[1]
[1] Institute of Photonics, University of Strathclyde, Technology and Innovation Centre, UK
[2] Department of Materials Science and Metallurgy, University of Cambridge, UK

12.00 -12.15 ***High-speed single pixel imaging using a GaN micro-LED array***
G. E. Johnstone[1], J. Gray[1], S. Bennett[2], P. Murray[2], S. D. Johnson[3], M. J. Padgett[3], C. F. Higham[4], R. Murray-Smith[4], F. Dehkhoda[5], R. K. Henderson[5], J. Herrnsdorf[1], M. D. Dawson[1], and M. J. Strain[1]*
[1] Institute of Photonics, Department of Physics, University of Strathclyde, Technology and Information Centre, UK
[2] Department of Electronic and Electrical Engineering, University of Strathclyde, UK
[3] School of Physics and Astronomy, University of Glasgow, UK
[4] School of Computing Science, University of Glasgow, UK
[5] School of Engineering, University of Edinburgh, UK

12:15- 12:45 Flash Presentations for posters

2 minutes per poster (maximum 3 slides)

12:45- 14:00 Lunch & Poster Session

14:00- 15:15 Session 6: UV Emitters - Matthew Halsall

14.00 -14.15 **The influence of point defects and threading dislocations on the opto-electronic properties of UV-C LEDs**

G. Kusch[1], Viesturs Spūlis[1], M. Schilling[2], F. Biebler[2], B. Belde[2], F. Mehnke[2], M. Guttmann[2], S. Hammersley, T. Wernicke[2], M. Kneissl[2], and R. A. Oliver[1]

[1] Dept. of Materials Science and Metallurgy, University of Cambridge, UK

[2] Technische Universität Berlin, Institute of Solid State Physics, Germany

14.15 -14.30 **Controlling Point Defects in AlGaN**

Douglas Cameron[1], Marcel Schilling[2], Gunnar Kusch[3], Paul R. Edwards[1], Tim Wernicke[2], Michael Kneissl[2], Rachel A. Oliver[3], and Robert W. Martin[1]

[1] Department of Physics, SUPA, University of Strathclyde, UK

[2] Institute of Solid-State Physics, Technische Universität Berlin, Germany

[3] Department of Materials Science and Metallurgy, University of Cambridge, UK

14.30 -14.45 **Ultraviolet-C CMOS-controlled micro-light-emitting diode array**

Jonathan J.D. McKendry[1] Enyuan Xie[1], Jordan Hill[1], Hichem Zimi[1], Johannes Herrnsdorf[1], Erdan Gu[1], Robert K. Henderson[2] and Martin D. Dawson[1]

[1] Institute of Photonics, Dept. of Physics, Univ. of Strathclyde, UK

[2] School of Engineering, Joint Research Institute for Integrated Systems, Institute for Micro and Nano Systems, University of Edinburgh, UK

14.45 -15.00 **Effect of Mg doping on polarisation-doped AlxGa1-xN (x < 0.35)**

P. Milner[1,2], V.Z. Zubialevich[1], S.M. Singh[1,2], R. Finn[1,2], B. Corbett[1], P.J. Parbrook[1,2]

[1] Tyndall National Institute, Ireland

[2] Dept of Electrical and Electronic Engineering, University College Cork, Ireland

15.00 -15.15 **Theoretical study of the influence of carrier density screening on Urbach tail energies in (Al,Ga)N quantum well systems**

Robert Finn[1], M. O'Donovan[2], T. Koprucki[2] and S. Schulz[1,3]

[1] Tyndall National Institute, University College Cork, Ireland

[2] Weierstrass Institute (WIAS), Germany

[3] School of Physics, University College Cork,Ireland

15:15- 15:45 Coffee *sponsored by IQE*

15.45-16:00 Closing Remarks & Student Prizes

16:00 Depart

Posters (11th Jan 2024 12:45-14:00)

Reducing GaN-on-diamond thermal boundary resistance by nanostructured interface

Xiaoyang Ji[1], Sai Charan Vanjari[1], Daniel Francis[2], Felix Ejeckam[2], Marko Tadjer[3], Travis Anderson[3], James W. Pomeroy[1], Martin Kuball[1]

[1] HH Wills Physics Laboratory, University of Bristol, UK

[2] Akash Systems, San Francisco, USA

[3] Naval Research Laboratory, Washington DC, USA

Constant photocurrent method to probe the sub-bandgap absorption in wide bandgap semiconductor films: the case of α-Ga_2O_3

D. Nicol[1], S. Reynolds[2], J. Roberts[3], J. Jarman[4] P. Chalker[3], and F. Massabuau[1]

[1] University of Strathclyde, Glasgow, UK

[2] University of Dundee, Dundee, UK

[3]University of Liverpool, Liverpool, UK

[4]University of Cambridge, Cambridge, UK

Sample size effects on chronoamperometry during electrochemical etching of porous GaN

Ben Thornley, Galih R. Suwito, Jiawei Zhang, Menno Kappers, and Rachel Oliver

[1]Department of Materials Science and Metallurgy, University of Cambridge, UK

Hybrid device fabrication using Mesoporous GaN Distributed Bragg Reflectors grown on Silicon

B. Guilhabert[1], S. Ghosh[2], M. Toons[1], D. Jevtics[1], M. Kappers[2], R.A. Oliver[2] and M.J. Strain[1]

[1] Institute of Photonics, University of Strathclyde, Technology and Innovation Centre, UK

[2] Department of Materials Science and Metallurgy, University of Cambridge, UK

Misorientation and luminescence of GaN microfins

J. Bruckbauer[1,2,], I. Manglano Clavero[3], C. Margenfeld[3], J. Hartmann[3], A. Waag[3], A. Winkelmann[2,4], C. Trager-Cowan[1,2], R. W. Martin[1]*

[1] Semiconductor Spectroscopy & Devices Group, Department of Physics, SUPA, University of Strathclyde, UK

[2] Advanced Materials Diffraction Lab, Department of Physics, SUPA, University of Strathclyde, UK

[3] Institute of Semiconductor Technology & Laboratory for Emerging Nanometrology (LENA), Technische Universität Braunschweig, Germany

[4] Academic Centre for Materials and Nanotechnology, AGH University of Krakow, Poland

Influences of the layer thickness on the morphological and optical properties of cubic GaN thin films grown on 3C-SiC

X. Xu[1], M. Frentrup[1], G. Kusch[1], M. J. Kappers[1], D. J. Wallis[1,2], and R. A. Oliver[1]

[1] Department of Materials Science and Metallurgy, University of Cambridge, UK

[2] Centre for High Frequency Engineering, University of Cardiff, UK

Investigations into the Structure-Property Relationship of Porous GaN

Jiawei Zhang, Benjamin Thornley, Galih R. Suwito, Saptarsi Ghosh, Menno Kappers, and Rachel Oliver

Cambridge Centre for Gallium Nitride, University of Cambridge, UK

Low-Temperature Conductivity of Porous Gallium Nitride (GaN)
Noppasorn Suphannarat, Saptarsi Ghosh, Francesca Adams, Abhiram Gundimeda, Maruf Sarkar, Menno J. Kappers and Rachel A. Oliver
Department of Materials Science and Metallurgy, University of Cambridge, UK

AlGaN as a barrier for vertical transport of electrons in a unipolar heterostructure
Sandeep M. Singh, Peter Milner, Vitaly Zubialevich, Stefan Schulz, and Peter Parbrook*
Tyndall National Institute, University College Cork, Ireland

Impact of Channel Layer Thickness in Buffer-Free AlGaN/GaN Hight Electron Mobility Transistor on SiC Substrates
Sahalu Hassan, Kaivan Karami, Afesomeh Ofiare, Abdullah Al-Khalidi, and Edward Wasige
School of Science and Engineering, University of Glasgow, UK

CrN/ TiN Multi-Graded Thin Film Sustainable Coatings on Metallic Alloys
A.M. Musanna[1], I. Efeoglu [2], G. Gülten[2], M.A. Maleque[2], M. Yeşilyurt[2], B. Yaylalı[2], B. G. Parvin[2]
[1] Department of Mechanical Engineering, James Watt School of Engineering, University of Glasgow, UK
[2] Department of Mechanical Engineering, Engineering Faculty, Atatürk University, Turkey
[3] Department of Manufacturing and Materials Engineering, International Islamic University Malaysia, Malaysia

Electrical characterization of defects induced in GaN thin film synthesized using electrodeposition by sputtering deposition
Ali Abdulraoof
University of Pretoria, South Africa & Univ. of Elimam Elmahdi, Sudan

Photoluminescence properties of BAlGaN/AlGaN quantum well heterostructures as a function of temperature
Olivia Shortall[1], Vitaly Z. Zubialevich[1], Thomas O'Connor[1], and Peter J. Parbrook [1,2]
[1] Tyndall National Institute, University College Cork, Ireland
[2] Department of Electrical and Electronic Engineering, School of Engineering, University College Cork, Ireland