

Programme Overview – 5th International Workshop on Bismuth-Containing Semiconductors

The 5th International Workshop on Bismuth-Containing Semiconductors will take place at Tyndall National Institute in July 2014.

The workshop will begin with a social reception on the evening of Sunday, July 20th and the technical programme runs from Monday, July 21st to Wednesday, July 23rd with a conference excursion around Cork City organised for Wednesday afternoon. The goal of the workshop is to bring together experimentalists and theoreticians who work on the physics, chemistry and engineering of bismuth-containing semiconductors.

The technical programme is organised into 11 sessions encompassing fundamental studies as well as ongoing progress towards realising specific applications of bismuth-containing semiconductors. In addition to oral presentations, the technical programme also includes a poster session – a first for the workshop series. Attendees presenting their work in poster form will be given the opportunity to outline their poster in a 2 minute oral presentation. The poster session takes place on Monday, July 21st but the posters will stay up for the first two days of the workshop in order to facilitate further discussions.

Invited talks are of 30 minutes duration, while contributed talks are of 15 minutes duration. 5 minutes will be allowed for questions and discussions at the end of each of the invited and contributed oral presentations.

Lunch will be provided on-site for all registered attendees on Monday, Tuesday and Wednesday.

Sunday, July 20th:

18:00 – 20:00 Social reception (Café Serendipity, Western Road, Cork)

Monday, July 21st:

08:50 – 10:40: Welcome address + Materials Growth and Characterisation I
Session Chair: Stephen Sweeney

08:50 – 9:05: Welcome Address and Meeting Overview

09:05 – 09:40 High Quality Bi₂Te₃ Thin Films Grown by Molecular Beam Epitaxy (**Invited**)
S. M. Wang, and Y. X. Song
Chinese Academy of Sciences and Chalmers University of Technology, Sweden

09:40 – 10:00 MBE growth and properties of InSbBi alloys
M. K. Rajpalke, W. M. Linhart, M. Birkett, K. M. Yu, T. S. Jones, M. J. Ashwin, T. D. Veal
University of Liverpool

10:00 – 10:20 Formation and phase transformation of Bi-containing quantum dot-like clusters in annealed GaAsBi
M. Wu, E. Luna, J. Puustinen, M. Guina, and A. Trampert
Paul-Drude-Institut für Festkörperelektronik, Berlin, Germany

10:20 – 10:50: Coffee break

10:50 – 12:10: Bi Interactions at Surfaces
Session Chair: Shane Johnson

- 10:50 – 11:10 Electronic structure of Bi nanolines and Haiku stripes on Si(001)
M. Longobardi, R. Villarreal, S. Koster, C. Kirkham, D. Bowler, and C. Renner
University of Geneva
- 11:10 – 11:30 Ab initio studies of atomic surface structure of Bi-containing III-V compound semiconductor alloys
A. Duzik, N. Modine, and J. M. Millunchick
University of Michigan
- 11:30 – 11:50 Influence of a bismuth surfactant on the composition of InAsSb
E. M. Anderson, W. L. Sarney, S. P. Svensson, B. Connelly, A. M. Lundquist, C. Pearson, P. J. Carrington, and J. M. Millunchick
University of Michigan
- 11:50 – 12:10 New insights into surface phenomena impacting Bi incorporation in MBE-Grown GaAsBi revealed from x-ray photoelectron spectroscopy (XPS) studies
W. Jiao, J. Li, T. Kim, A. Wood, T.F. Kuech, S. Babcock, and A. S. Brown
Duke University

12:15 – 12:45 Poster Overview

Session Chair: Eoin O'Reilly

- P1 Carrier localization and electron spin relaxation dynamics in GaAsBi
S. Mazzucato, H. Carrère, A. Arnoult, C. Fontaine, T. Amand, and X. Marie
Université de Toulouse
- P2 Theory of the enhancement of the electron effective g-factor in GaBiAs/GaAs epilayers
C. A. Broderick, M. Usman, and E. P. O'Reilly
Tyndall National Institute
- P3 First-principles calculations on electronic and structural properties of BGaAsBi alloys
M. Aslan, B. G. Yalcin, and M. Ustundag
Sakarya University, Turkey
- P4 Bismide-nitrides for solar cell and related applications
S. J. Sweeney, K. Hild, S. R. Jin, Z. Batool, Z. Bushell, P. Ludewig, N. Knaub, W. Stolz, and K. Volz
University of Surrey
- P5 An investigation of Bismuth-related effects on GaAsBi/GaAs epilayers
E. Akalin, Ayse Erol, M. Aslan, K. Kara, M. Ç. Arıkan, V. Bahrami Yekta, and T. Tiedje
Istanbul University
- P6 The opto-electronic characteristics of GaAs/GaAsBi/GaAs PIN diodes
Z. Zhou, D. F. Mendes, R. D. Richards, F. Bastiman, and J. P. R. David
University of Sheffield
- P7 First-principles Simulation on the Molecular Beam Epitaxy Growth of GaAs_{1-x}Bi_x
Guangfu Luo, Shujang Yang, Mehrdad Arjmand, Izabela Szlufarska, Jincheng Li, April S. Brown, Thomas F. Kuech, and Dane Morgan
- P8 The effect of the Bi precursors, TMBi and TEBi, on the metal-organic vapour phase epitaxy (MOVPE) of GaAsBi films
K. Forghani, Y. Guan, A. Wood, S. Babcock, L. Mawst, and T. F. Kuech
University of Wisconsin-Madison

- P9 The defect chemistry of GaSb and InSb doped with Bi and N
J. Buckeridge, D. O. Scanlon, and C. R. A. Catlow
University College London
- P10 Bi₂Te₃ Thin Films Grown on Vicinal GaAs (111)B Substrates by MBE
Y. X. Song, S. Charpentier, F. Lombardi, and S. M. Wang
Chinese Academy of Sciences, Shanghai, China
- P11 Alloy Disorder Effects in GaBiAs/GaAs quantum wells
M. Usman, C. A Broderick, and E. P. O'Reilly
University of Melbourne
- P12 Photomodulated reflectance and Photoluminescence Study on GaAsBi Epilayers grown by Molecular Beam Epitaxy
Omer Donmez, Metin Aslan, Ayse Erol, Çetin Arıkan, Vahid Bahrami Yekta, Ryan B. Lewis, Tom Tiedje Hajer Makhloufi, Alexandre Arnoult, and Chantal Fontaine
- P13 Properties of GaAsBi/GaAs quantum well structures with different Bi distribution profiles.
S. R. Jin, K. Hild, I. P. Marko, Z. Batool, and S. J. Sweeney
University of Surrey
- P14 Thermoelectric properties of GaAs_{1-x}Bi_x semiconductors
A. H. Reshak, S. A. Khan, and S. Auluck
University of West Bohemia

12:45 – 14:00 Lunch and Posters

14:00 – 15:15: Bismide Alloys for Device Applications I

Session Chair: Luke Mawst

- 14:00 – 14:35 Characterisation of GaAsBi diodes
J.P.R. David, R. D. Richards, C. J. Hunter, and F. Bastiman **(Invited)**
University of Sheffield
- 14:35 – 14:55 Carrier recombination in GaBiAs/(Al)GaAs laser diodes
I. P. Marko, S. R. Jin, K. Hild, Z. Batool, P. Ludewig, N. Knaub, W. Stolz, K. Volz, and S. J. Sweeney
University of Surrey
- 14:55 – 15:15 Improvement of MBE-grown GaAsBi quantum wells for laser applications
V. Bahrami Yekta, M. Masnadi-Shirazi, T. Tiedje, and Ryan Lewis
University of Victoria

15:15 – 16:15: Tea and Posters

16:15 – 17:15: Structural Characterisation

Session Chair: Rachel Goldman

- 16:15 – 16:35 Triple-period atomic ordering and V-shaped features in low temperature Ga(As,Bi)
E. Luna, M. Wu, J. Puustinen, M. Guina, and A. Trampert
Paul-Drude-Institut für Festkörperelektronik
- 16:35 – 16:55 Raman scattering reveals bismuth-induced effects in nominally undoped GaAs_{1-x}Bi_x
J. A. Steele, R. A. Lewis, M. Henini, O. M. Lemine, D. Fan, Yu. I. Mazur, V. G. Dorogan, P. C. Grant, S.-Q. Yu, and G. J. Salamo
University of Wollongong

16:55 – 17:15 Bi clustering in GaAs_{1-x}Bi_x alloys: A theoretical study
P. J. Punkkinen, P. Laukkanen, M. Kuzmin, and K. Kokko
University of Turku

Tuesday, July 22nd:

09:00 – 10:35: Materials Growth and Characterisation II
Session Chair: Shumin Wang

09:00 – 09:35 Growth and Characterization of Binary III-Bi Thin Films **(Invited)**
B. Keen, R.A. Makin, P.A. Stampe, R.J. Kennedy, L.F.J. Piper, D.O. Scanlon, and S.M. Durbin
Western Michigan University

09:35 – 09:55 Growth, Structural, and Optical Properties of InAsBi
S. R. Johnson, P. T. Webster, N. A. Riordan, C. Gogineni, S. Liu, Y.-H. Zhang, J. Lu, and D. J. Smith
Arizona State University

09:55 – 10:15 MBE growth and properties of high Bi content GaSbBi alloys
W. M. Linhart, M. K. Rajpalke, M. Birkett, K. M. Yu, T. S. Jones, M. J. Ashwin, and T. D. Veal
University of Liverpool

10:15 – 10:35 Photoreflectance studies of the band gap of III- Sb- Bi diluted by bismides
J. Kopaczek, R. Kudrawiec, W. M. Linhart, M. K. Rajpalke, T. S. Jones, M. J. Ashwin, J. Misiewicz, and T. D. Veal
Wrocław University of Technology

10:35 – 11:05: Coffee break

11:05 – 12:40: Electronic and Optical Properties I
Session Chair: John David

11:05 – 11:40 Spin properties of dilute bismide alloys **(Invited)**
H. Carrère, S. Mazzucato, H. Lehec, T. T. Zhang, D. Lagarde, P. Boonpeng, A. Arnoult, G. Lacoste, A. Balocchi, T. Amand, C. Fontaine, and X. Marie
LPCNO, INSA-UPS-CNRS

11:40 – 12:00 The dilute bismide alloy, GaAs_{1-x}Bi_x and the dynamics of carriers and phonons
R. N. Kini, J. Shyamala, A. J. Ptak, R. France, and A. Mascarenhas
Indian Institute of Science Education and Research

12:00 – 12:20 Experimental characterisation and determination of band-offsets in GaBiAs quantum well lasers
P. E. Harnedy, C. A. Broderick, R. J. Manning, and E. P. O'Reilly
Tyndall National Institute

12:20 – 12:40 Quaternary dilute bismuthides and selected application: photon upconversion
J. M. O. Zide, Y. Zhong, P. B. Dongmo, D. G. Sellers, E. Chen, J. Zhang, and M. F. Doty
University of Delaware

12:40 – 14:00: Lunch

14:00 – 15:15 Bismide Alloys for Device Applications II

Session Chair: Tom Tiedje

14:00 – 14:20 GaAsBi laser diodes fabricated by molecular beam epitaxy
M. Yoshimoto, R. Yoshioka, K. Yoshida, and T. Fuyuki
Kyoto Institute of Technology

14:20 – 14:40 Requirements for a GaAsBi 1eV sub-cell in a GaAs based multi-junction solar cell
T. Thomas, A. Mellor, N. Hylton, M. Führer, D. A. Alvarez, A. Braun, N.J. Ekins-Daukes, J. P. R. David, and S. J. Sweeney
Imperial College London

14:40 – 15:15 Growth and characterisation of dilute Bi quantum wells for laser applications
(Invited)
A. Krotkus, R. Butkutė, V. Pačebutas, A. Geižutis, I. P. Marko, S. J. Sweeney, P. Ludewig, and K. Volz
Center for Physical Sciences and Technology, Vilnius

15:15 – 15:45: Coffee break

15:45 – 17:05: Annealing and Structural Characterisation

Session Chair: Kerstin Volz

15:45 – 16:05 On the Bi diffusion from (001) GaAsBi-GaAs quantum wells during high temperature annealing
A. Arnoult, A. Kuck, H. Makhloufi, P. Boonpeng, S. Mazzucato, T. T. Zhang, J. Nicolai, A. Ponchet, F. Cristiano, T. Hungria, D. Lagarde, G. Lacoste, H. Carrère, X. Marie, and C. Fontaine
Université de Toulouse

16:05 – 16:25 Z-contrast STEM imaging of compositional modulations in GaAs_{1-x}Bi_x
A. W. Wood, J. Li, K. Forghani, T. F. Kuech, A. S. Brown, and S. E. Babcock
University of Wisconsin-Madison

16:25 – 16:45 Thermal annealing on InP_{1-x}Bi_x grown by molecular beam epitaxy
X. Y. Wu, K. Wang, W. W. Pan, Y. Y. Li, Y. X. Song, L. Y. Zhang, Y. Gu, Q. Gong, and S. M. Wang
Shanghai Institute of Microsystem and Information Technology

16:45 – 17:05 Raman Scattering of InPBi Grown by Molecular Beam Epitaxy
W. W. Pan, K. Wang, X. Y. Wu, Y. X. Song, Q. Gong, and S.M. Wang
Chinese Academy of Sciences

17:10 Tour of Tyndall Facilities

20:00 Conference Dinner, Aula Maxima, University College Cork

Wednesday, July 23rd:

09:00 – 10:20: Materials Growth and Characterisation III

Session Chair: Joanna Millunchick

09:00 – 09:20 Metal-organic vapour phase epitaxy (MOVPE) of high Bi content GaAsPBi “bulk” layers, lattice matched to GaAs
K. Forghani, Y. Guan, G. Luo, M. Losurdo, A. Wood, S. Babcock, L. Mawst, D. Morgan, A.

S. Brown, and T. F. Kuech
University of Wisconsin-Madison

09:20 – 09:40 Strain and relaxation in GaAsBi/GaAs multiple quantum well structures
R. D. Richards, F. Bastiman, D. Walker, R. Beanland, and J. P. R. David
University of Sheffield

09:40 – 10:00 MOVPE growth of Ga(AsBi)/GaAs heterostructures using alternative sources
L. Nattermann, P. Ludewig, L. Meckbach, R. Straubinger, B. Ringle, C. von Hänisch, W. Stolz, and K. Volz
Philipps-Universität Marburg

10:00 – 10:20 Raman Spectroscopy of Epitaxial Topological Insulator Bi₂Te₃ on GaN
H. Xu, Y. X. Song, Q. Gong, and S. M. Wang
Shanghai Institute of Microsystem and Information Technology

10:20 – 10:50: Coffee break

10:50 – 12:45: Electronic and Optical Properties II
Session Chair: Chantal Fontaine

10:50 – 11:25 Amphoteric doping of GaAsBi alloys with silicon (**Invited**)
R. L. Field III, T. Jen, J. Occena, B. Yarlagadda, C. Kurdak, and R. S. Goldman
University of Michigan

11:25 – 11:45 Theory of the electronic and optical properties of dilute bismide quantum well lasers
C. A. Broderick, P. E. Harnedy, and E. P. O'Reilly
Tyndall National Institute

11:45 – 12:05 Strain-compensated GaAsP/GaAsBi(P)/GaAsP quantum wells for laser applications
L. J. Mawst, K. Forghani, Y. Guan, A. Anand, H. Kim, T. Kim, A. Wood, S. Babcock, and T. F. Kuech
University of Wisconsin-Madison

12:05 – 12:25 Experimental and modelling study of InGaAsBi/InP alloys with up to 5.8% Bi, and with $\Delta_{so} > E_g$
G. M. T. Chai, S. R. Jin, K. Hild, Z. Batool, I. P. Marko, J. P. Petropoulos, Y. Zhong, P. B. Dongmo, J. M. O. Zide, S. J. Sweeney, and T. J. C. Hosea
Universiti Teknologi Malaysia

12:25 – 12:45 Annealing-induced long-wavelength photoluminescence in GaAsBi
J. Puustinen, J. Hilska, M. Wu, E. Luna, and M. Guina
Tampere University of Technology,

12:45 – 13:00: Closing address

13:00 – 14:00: Lunch

14:30 Tour of Cork City, including visit to Cork City Gaol, leaving from Grand Parade (outside the Main Tourist Office).