

USYD – Yonsei Virtual Research Roundtable II on “Functional Energy Materials”

Biography of Chairs and Academics

The University of Sydney



Professor Philip Gale

Head, School of Chemistry, Faculty of Science

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Philip A. Gale received his BA (Hons) in 1992 and his MA and DPhil in 1995 from the University of Oxford before moving to the University of Texas at Austin where he spent two years as a Fulbright Scholar. In 1997 he returned to the Inorganic Chemistry Laboratory at Oxford as a Royal Society University Research Fellow. He moved to a Lectureship at the University of Southampton in 1999 and was promoted to Senior Lecturer in 2002, Reader in 2005 and to a Personal Chair in Supramolecular Chemistry in 2007. From 2010 - 2016, Phil served as the Head of Chemistry at Southampton. In 2014 he was awarded a Doctor of Science degree by the University of Oxford. In January 2017 he moved to the University of Sydney to take up the position of Professor of Chemistry and Head of the School of Chemistry.

Phil is the author or co-author of over 280 publications including an Oxford Chemistry Primer on Supramolecular Chemistry with Paul Beer and David Smith (1999) and an RSC Monograph in Supramolecular Chemistry entitled Anion Receptor Chemistry with Jonathan Sessler and Won-Seob Cho (2006). He is the co-editor in chief (with Jonathan Steed) of an eight-volume reference work published by Wiley entitled Supramolecular Chemistry: from molecules to nanomaterials and of the RSC's Monographs in Supramolecular Chemistry.

Phil's research has been recognised by a number of research awards including the 2018 International Izatt-Christensen Award in Macrocyclic and Supramolecular Chemistry, the RSC 2014 Supramolecular Chemistry Award, a Royal Society Wolfson Research Merit Award (2013), the RSC Corday Morgan medal and prize (2005), the Society/Journal of Porphyrins and Phthalocyanines Young Investigator Award (2004) and the RSC Bob Hay Lectureship (2004).

He was listed by Thomson Reuters as a Highly Cited Researcher in chemistry in both 2014 and 2015 and as a Web of Science Highly Cited Researcher in 2016, 2017, 2018 and 2019.

In 2010 Phil was awarded a JSPS invitation fellowship that he took up at Kyushu University, Japan in 2011. In 2012 he was appointed as a Guest Professor by Xiamen University, China (2012-2014), giving the prestigious Tan Kah Kee chemistry lecture there in 2013. He was awarded a University of Canterbury Erskine Visiting Fellowship and spent two months in Christchurch, New Zealand in 2014.

**Dr Lauren Macreadie****School of Chemistry, Faculty of Science**

Email: lauren.macreadie@sydney.edu.au

Biographical details

Lauren K. Macreadie received her double degree BBiomed/BSc (Hons) from Monash University in 2011 and then completed her PhD at the CSIRO in 2016. She then moved to Trinity College Dublin in Ireland as a post-doctoral fellow to investigate metal-organic framework (MOF) water splitting catalysts. Following this role she moved back to the CSIRO in 2017 to work on commercial projects with the Defence Scientific and Technology Group (DSTG), followed by some fundamental research into MOFs on a CSIRO OCE Postdoctoral Scheme. This work led to her accepting a position as a Lecturer at Massey University in New Zealand in 2019. In June 2020 she moved to the University of Sydney to accept a role as a PDF working with Prof Phil Gale on supramolecular anion transport systems and MOFs.

Research interests

- Metal-organic frameworks (MOFs)
- Supramolecular chemistry
- Materials chemistry
- X-ray diffraction
- Nanoporous materials

Topic of research presentation

Functional MOF materials for hydrocarbon separations for hydrogen delivery applications

Summary of research presentation

This important project addresses the key question of identifying a solid adsorbent material to safely, and efficiently, store and deliver hydrogen. This project is broken down into 3 aims of identifying a champion material for both catalytic hydrogen formation and storage, then enhancing its heat transfer properties, and verifying its performance within industry. Aim 1: This project will identify MOFs with specialised void spaces for either the selective separation of LOHCs or forming hydrogen from catalytic reactions under ambient conditions. This work will involve chemical synthesis and then testing and characterising the material sorbent properties to identify target, champion candidates. Aim 2: Magnetic nanoparticles can be used to induce thermal energy from within a porous material. Using top-performing MOFs identified in Aim 1, we will form magneto-MOF composites. A magnetic field will be introduced to the material when loaded with a LOHC to generate an in-situ heat source and drive off hydrogen. The separation and adsorption properties of these materials will be compared to the original materials to ensure they maintain their properties.

**Professor Chris Ling**

Theme Leader for Functional Energy Materials, School of Chemistry, Faculty of Science

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Biographical details

BSc, University of Melbourne (1992–1994)

BSc (Hons 1), Australian National University (1995)

PhD, Research School of Chemistry, Australian National University (1996–1999)

Postdoctoral Fellow, Materials Science Division, Argonne National Laboratory, USA (1999-2001)

Physicist, Diffraction Group, Institut Laue-Langevin, France (2001-2004)

Lecturer, School of Chemistry, University of Sydney (2004-2007)

Senior Lecturer, School of Chemistry, University of Sydney (2008-2011)

Associate Professor, School of Chemistry, University of Sydney (2012-2017)

Professor of Solid-state Chemistry, School of Chemistry, University of Sydney (2018-)

Research interests

Solid-state materials chemistry

Magnetic materials

Energy storage and conversion materials

Solid-oxide fuel cells

Batteries

Solid-state ionic conductors

Neutron scattering

Synchrotron X-ray science

Crystallography

Phase transitions

Modulated structures

Crystal growth

Topic of research presentation

In situ/operando X-ray and neutron scattering studies of high-voltage solid-state battery materials at high voltage.

Summary of research presentation

The rational design of functional materials requires knowledge of their crystal structures and how they evolve under operating conditions. This is particularly challenging for solid-state battery electrode materials, because (a) they are a relatively small part of a complex assembly of other materials, and (b) the most important phases only exist under high applied voltages and cannot be quenched and removed. In this talk I will present recent technical advances we have made in the design and execution of in situ/operando X-ray and neutron scattering experiments at the Australian Synchrotron and the Australian Centre for Neutron Scattering, and some scientific results obtained from those experiments.



Professor Brendan Kennedy

Professor of Chemistry, School of Chemistry, Faculty of Science

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Biographical details

B.Ed. Melb. SC

Ph.D. Monash University

Postdoctoral Fellow, Oxford University and ANU

The University of Sydney (1998 to present)

Research interests

Solid State and Materials Chemistry

Crystallography - X-ray and Neutron Scattering

Structure and Bonding in Metal Oxides

Topic of research presentation

Beyond Batteries. Uncoupling local and long-range structures in complex oxides.

Summary of research presentation

The need to transition to a low carbon economy is obvious. What is less obvious is how to generate, store and release energy in a closed carbon economy. Fuel cells, using solar hydrogen, and nuclear energy will be central to any future energy mix. Bizarrely pyrochlore oxides are of interest in both fuel cells and the nuclear fuel cycle. In the former the ability of pyrochlores to conduct oxide ions at relatively low temperatures sees them employed as solid oxide conductors. The resistance of pyrochlores to radiation induced amorphization is of importance in the management of nuclear waste. In this presentation I will briefly review our work that demonstrates the importance of both the long range and local structures for these applications.



Professor Cameron Kepert

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CO2MOF Network Group / Contact Details / The Kepert Group

Biographical details

BSc (Hons. I), University of Western Australia

PhD, Royal Institution of Great Britain/University of London

Junior Research Fellow (Christ Church), University of Oxford

Appointed at the University of Sydney, 1999

ARC Federation Fellowship, 2005

Liversidge Lectureship, RSNSW, 2008

Australasian Lectureship, RSC, 2009

Research interests

- Materials chemistry
- Molecular framework materials
- X-ray diffraction
- Nanoporosity
- Electronic and magnetic properties of solids
- Phase transitions (structural, electronic and magnetic)



Dr Girish Lakhwani

Senior Lecturer, Honours and Graduate Diploma Coordinator, School of Chemistry, Faculty of Science

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Biographical details

M.Sc (Integrated), Indian Institute of Technology, Kanpur, India, 2005

PhD, Eindhoven University of Technology, the Netherlands, 2009

Postdoctoral Research Associate, University of Texas at Austin, USA, 2009-2011

Postdoctoral Research Associate, University of Cambridge, UK, 2011-2014

Lecturer, University of Sydney, 2014-2017

Senior Lecturer, University of Sydney, 2018-present

Research interests

Our research activities are focussed on developing spectroscopic methods to study optical and electronic properties of novel nanoscale semiconductor materials for solar energy harvesting and polarisation switching. Our research can be broadly classified in the following domains.

- Chirality and chiroptical spectroscopy
- Single molecule fluorescence spectroscopy, super-resolution spectroscopy
- Organic electronic devices, e.g., solar cells, light emitting-diodes and lasers
- Master equation based numerical simulations



Dr Alexander Yuen

Postdoctoral Research Associate, School of Chemistry, Faculty of Science

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Biographical details

BSc (Hons I, Medal), University of Sydney, 2001

PhD, University of Sydney, 2006

Postdoctoral Research Associate, The University of Sydney, 2006

Postdoctoral Fellow, CEA - Saclay, 2006–2008

Postdoctoral Fellow, University of Sydney, 2009–2011

SIEF project leader University of Sydney, 2012–2016

Research interests

Hydrothermal chemistry

Biofuel applications of macroalgae and lignocellulosics

Preparation and use of renewable chemicals from biomass

Synthesis of nanostructured materials and nanoparticles

Catalysis

Yonsei University



Professor Injae Shin

Head, Department of Chemistry, College of Science

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Biographical details

Injae Shin received his BS (1985) and MS degrees (1987) in Chemistry from Seoul National University in Korea. His Ph.D. research was performed at University of Minnesota with Professor Hung-wen Liu (1991-1995). After postdoctoral studies at University of California at Berkeley with Professor Peter Schultz (1995-1998), he began his independent career as an Assistant Professor of Chemistry at Yonsei University in Korea in 1998. He was promoted to an Associate Professor in 2001 and then a Professor in 2006. He is a Fellow of the Korean Academy of Science and Technology and a Fellow of the Royal Society of Chemistry. He serves as the editorial advisory boards of Chem. Soc. Rev., ChemBioChem, and Mol. BioSyst. Injae was a Lead of National Research Laboratory for Chemical Biology (2005-2009) and then a Director of Center for Biofunctional Molecules (2010-2019). He also serves as the National Representative for International Carbohydrate Organization and Asian Chemical Biology Conference.

Injae's research has been recognized by several research awards including Chang Sehee Award (2007), Monthly Best Scientist and Engineer Award (2012), Park In Won Award (2014), Yonsei University Award for Academic Excellent (2017), and Lee Daesil Award (2018).

His research interests include the synthesis of biologically important compounds, development of bioactive molecules that regulate biological processes, and functional studies of glycans using chemical tools including glycan microarrays.



Professor Dongil Lee

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Biographical details

B.S. Yonsei University, 1988

M.S. Yonsei University, 1990

Ph.D. University of Cambridge, 1996-2000

Research Scientist, LG Chem, 1990-1996

Postdoctoral Fellow, University of North Carolina, 2000-2003

Assistant Professor, Western Michigan University, 2003-2008

Professor, Yonsei University (2008 to present)

Research interests

Metal Nanoclusters

Electrocatalytic Chemical Conversion

Biological Applications of Metal Nanoclusters

Topic of research presentation

Electrocatalytic CO₂ Conversion on Metal Nanoclusters

Summary of research presentation

Development of efficient and selective electrocatalysts is a key challenge to achieve an industry-relevant electrochemical CO₂ reduction reaction (CO₂RR)

to produce commodity chemicals. In this presentation, I report that Au₂₅ clusters with Au-thiolate staple motifs can initiate electrocatalytic reduction of CO₂ to CO with nearly zero energy loss and achieve a high CO₂RR current density of 540 mAcm⁻² in a gas phase reactor. Electrochemical kinetic investigations revealed that the high CO₂RR activity of the Au₂₅ originates from the strong CO₂ binding affinity, leading to high CO₂ electrolysis performance in both concentrated and dilute CO₂ streams.



Professor Hyun S. Ahn

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Biographical details

B.S. Chemistry and Chemical Engineering, University of Washington, 2008

Ph.D. Chemistry, University of California Berkeley (Advisor T. Don Tilley), 2013

Postdoctoral Fellow University of Texas (Advisor Allen J. Bard), 2014-2016

Research interests

Electrochemical Energy Conversion

Nanoelectrochemistry and Electron Transfer Phenomena in Confinement

Electrochemical Synthesis of Nanomaterials

Topic of research presentation

Ruthenium-based Trimetallic μ -oxo Cluster Compounds and Their Application in Redox Flow Batteries

Summary of research presentation

Redox flow battery (RFB) is an energy storage technology garnering much attention of recent. Its unique architecture allowing for the separation of peak power and total amount of energy stored presents RFB as an attractive candidate for modulating load fluctuations in large scale applications such as buildings and power plants. We are developing RFBs based on trimetallic μ -oxo bridged compounds. These class of materials are suitable for RFB application due to their rich and well-defined electrochemistry with wide potential window. Synthesized compounds typically revealed good RFB cycle stability with greater than 1 V output at discharge, with the best discovered combination of materials exhibiting outstanding battery performance with 2.5 V discharge at 4 mAcm⁻². Increasing energy density by boosted solubility is currently underway, by means of ligand modifications.



Professor Byeong-Su Kim

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Biographical details

B.S. Chemistry, Seoul National University (1999)

M.S. Organic Chemistry, Seoul National University (2001)

Ph.D. Polymer/Material Chemistry, University of Minnesota-Twin Cities (2007)

Postdoctoral Associate, Massachusetts Institute of Technology (2007-2009)

Assistant and Associate Professor, Ulsan National Institute of Science and Technology (UNIST) (2009-2018)

Associate Professor, Yonsei University (2018-present)

Research interests

Soft and Hybrid Nanomaterials for Energy and Biomedical Applications

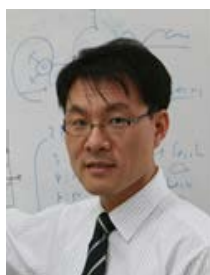
Chemistry of nanocarbons (carbon based electrocatalysts and organic catalysts; layer-by-layer assembled electrode)
Polyethers and polymeric therapeutics (Synthesis and characterizations of responsive polyethers, Polymers for biomedical applications)

Topic of research presentation

Designer Carbon Nanodots: Synthesis and Applications in Energy

Summary of research presentation

As the latest addition to the carbon nanomaterials family, carbon nanodots (CDs) have recently received considerable attention by virtue of their interesting physical, optical, and chemical properties, such as their photoluminescence, photostability, and electron transfer behavior. In this presentation, we will first outline the progress of the synthetic approaches of CDs based on various small molecular precursors. Moreover, we will discuss their interesting photo-driven electron transfer behavior within the framework of energy related applications, particularly in the solar-driven photocatalytic production of hydrogen peroxide.



Professor Woo Dong Jang

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Biographical details

1990–1997 B.S. Kyungpook National University

1998–2000 M.S. The University of Tokyo, Japan

2000–2003 Ph.D. The University of Tokyo, Japan

2003–2005 Postdoctoral Researcher JST CREST, The University of Tokyo

2005–2006 Assistant Professor, Dept. of Mater. Eng., The University of Tokyo

2006–Present: Professor, Department of Chemistry, Yonsei University

Research interests

Supramolecular chemistry, stimuli-responsive materials



Professor Sang-Yong Ju

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Biographical details

B.S. Industrial Chemistry, Hanyang University, 1998

M.S. Industrial Chemistry, Hanyang University, 2000

Researcher Korean Institute of Science and Technology, 2000–2002

Ph.D. Institute of Materials Science, University of Connecticut (Advisor Fotios Papadimitrakopoulos), 2008

Postdoctoral Fellow Cornell University (Advisor J. Park), 2014–2016

Research interests

Separation and Photophysics of Carbon Nanotubes for Energy Application

Growth of Graphene and Transition Metal Dichalcogenides

Development of Novel Optical Platform for Two Dimensional Materials



Professor Yong-Sun Bahn

Vice President of University-Industry Foundation, Vice President of Yonsei University Technology Holdings

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Biographical details

B.S. Yonsei University, 1995

M.S. Yonsei University, 1997

Ph.D. The Ohio State University, 1997-2003

Postdoctoral fellow, Duke University, 2003-2006

Full-time lecturer, Soongsil University, 2006-2008

Professor, Yonsei University (2008 to present)

Fellow, American Academy of Microbiology (2019 to present)

Research interests

Fungal genetics and pathogenesis

Medical mycology

Antifungal drug development

Host-Microbiome interaction