

# New Zealand Hydrogen Symposium

2024 III I I

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Paihau—Robinson  
Research Institute



2024



Wednesday 31 January 2024

## Symposium Opening

**Chair:** Dr John V. Kennedy

08:00	Venue open Registration and coffee
08:45	Please be seated
08:45 – 09:00	Powhiri (traditional welcome)
09:00 – 09:10	Opening address <i>Chelydra Percy – Chief Executive, GNS Science</i>
09:10 – 09:20	Opening remarks <i>Dr John V. Kennedy – Chair NZHS 2024, GNS Science</i>
09:20 – 09:55	<b>Plenary:</b> Solar harvesting through catalysis to make chemical and fuel <i>Prof Rose Amal – ARC Laureate Fellow, University of New South Wales</i>
09:55 – 10:20	Morning tea

## Session 1

**Chair:** Prof Aaron Marshall | **Theme:** Hydrogen Production

10:20 – 10:55	<b>Plenary:</b> Hydrogen perspective in Japan <i>Mr Ohira Eiji – Director General, Fuel Cell &amp; Hydrogen Group, NEDO</i>
10:55 – 11:20	<b>Invited:</b> Nanomaterials for photoelectrochemical H <sub>2</sub> production <i>Prof Lianzhou Wang – The University of Queensland</i>
11:20 – 11:35	The role of interfaces in ionomer-based water electrolysis <i>Dr Adam Weber – Lawrence Berkeley National Laboratory</i>
11:35 – 11:50	Ru-based catalysts for the proton exchange membrane water electrolyzers: The need to look beyond just another catalyst <i>Dr Shailendra Kumar Sharma – University of Canterbury</i>
11:50 – 12:05	Are we fully utilizing our proton exchange membrane water electrolyser? <i>Prof Meng Wai Woo – The University of Auckland</i>
12:05 – 12:20	NSW Powerfuel including Hydrogen Network: A collaboration platform to accelerate Power-to-X <i>Thomas Gao – NSW Decarbonisation Innovation Hub</i>
12:05 – 12:20	Group photo
12:20 – 13:25	Lunch

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## Session 2

**Chair:** Sheena Thomas | **Theme:** Industry and Commercialisation

	Commercial and industry perspectives
13:25 – 14:40	<i>Speakers from PlugPower, CleanTech, Bspkl, Liquium, NZ Growth Capital, Hyundai NZ</i>
	Panel discussion
14:40 – 15:10	<i>Nicoletta Moss – Mitsui, Ojas Mahapatra – Fabrum, Christina Houlihan – Bspkl, Matt Carnachan – Hiringa Max Thompson – NZ Growth Capital</i>
15:10 – 15:35	Afternoon tea

## Session 3

**Chair:** Prof Anna Garden | **Theme:** Hydrogen Storage and Distribution

15:35 – 15:50	An overview of the hydrogen storage research group (HSRG) at Curtin University <i>Prof Craig Buckley – Curtin University</i>
15:50 – 16:05	Mesoscale modeling of microstructural mechanisms of materials performance and degradation in hydrogen storage and production systems <i>Dr Tae Wook Heo – Lawrence Livermore National Laboratory</i>
16:05 – 16:20	Hydrogen storage materials: Challenges and opportunities <i>Prof Zhenguo Huang – University of Technology Sydney</i>
16:20 – 16:35	Synergistic theoretical-experimental approaches in metal hydride research for solid-state hydrogen storage <i>Dr Paul Jerabek – Helmholtz-Zentrum Hereon</i>
16:35 – 16:50	Energy-efficient catalysts for green ammonia synthesis <i>Dr Mohsen Maddah – Liquium</i>
16:50 – 17:05	Electrochemical ammonia production based on transition metal nitrides <i>Zulfitri Rosli – GNS Science</i>
17:05 – 17:20	Green hydrogen for urban energy systems and industries: Lessons from Germany <i>Dr Alaa Alhamwi – German Aerospace Center (DLR)</i>
17:20 – 17:30	Closing remarks

Thursday 01 February 2024

## Session 1

**Chair:** Rebecca Peer | **Theme:** Hydrogen Energy Systems

8:30 – 8:40	Opening Remarks <i>Dr Michelle Cook – Deputy Chair NZHS 2024, GNS Science</i>
8:40 – 9:15	<b>Plenary:</b> Australia's hydrogen industry journey <i>Dr Patrick Hartley – Mission Leader, CSIRO Hydrogen Industry Mission</i>
9:15 – 9:40	<b>Invited:</b> Future hydrogen infrastructures – a European perspective <i>Dr Hans-Christian Gils – German Aerospace Center (DLR)</i>
9:40 – 9:55	Metal hydride systems for H <sub>2</sub> compression <i>Dr Ashleigh Cousins – CSIRO</i>
9:55 – 10:10	Net zero housing – Green hydrogen from solar roofing <i>Dr Ashton Partridge – University of Auckland</i>
10:10 – 10:25	Green hydrogen production potential at city level: A GIS-based approach for New Zealand <i>Stella Nadine Steidl – University of Canterbury</i>
10:25 – 10:40	Risk communication and public acceptance of hydrogen <i>Christina Benighaus – Karlsruhe Institute of Technology (KIT)</i>
10:40 – 11:05	Morning Tea

## Session 2

**Chair:** Prof Geoff Waterhouse | **Theme:** Hydrogen Production

11:05 – 11:30	<b>Invited:</b> Solar technology and hydrogen production: Exploring the frontiers of science <i>Dr Noel Duffy – CSIRO</i>
11:30 – 11:55	<b>Invited:</b> Interface controlled nanocatalysis for hydrogen evolution <i>Prof Wei Chen – National University of Singapore</i>
11:55 – 12:10	Self-repairing anode catalysts for alkaline water electrolysis powered by renewable energy <i>Dr Yoshiyuki Kuroda – Yokohama National University</i>
12:10 – 12:25	Enhancing electrocatalysis via mechanical energy conversion <i>Dr Peter Sherrell – RMIT University</i>
12:25 – 12:40	Utilizing synchrotron radiation for insights into catalyst behavior during operation <i>Dr Yan-Gu Lin – National Synchrotron Radiation Research Center</i>
12:40 – 12:55	A critical analysis of using an in-situ reference electrode to decouple anode-cathode dynamics in an anion exchange membrane water electrolyser <i>Laura Titheridge – University of Canterbury</i>
12:55 – 13:50	Lunch

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## Session 3

**Chair:** Robert Holt | **Theme:** Hydrogen Utilisation

13:50 – 14:25	<b>Plenary:</b> Overview of the U.S. DOE hydrogen production and storage consortia: A computational perspective <i>Dr Brandon Wood - Associate Programme Lead for Hydrogen, Lawrence Livermore National Laboratory</i>
14:25 – 14:50	<b>Invited:</b> Optimising the Transition to Hydrogen Trucks: A Fleet Replacement Strategy for New Zealand <i>Dr Selena Sheng – The University of Auckland</i>
14:50 – 15:05	The Role of (H <sub>2</sub> -Diesel) Dual Fuel Heavy Vehicles in Decarbonizing Heavy Transport in New Zealand <i>Alhasan Abdulwahid - University of Otago</i>
15:05 – 15:20	Electrochemical reduction of carbon dioxide <i>Prof Jie Zhang – Monash University</i>
15:20 – 15:35	How to make hydrogen fuel cells cheaper and more efficient? <i>Dr Quentin Meyer – University of New South Wales</i>
15:35 – 15:50	Utilization of green hydrogen to drive a sustainable zero-emission wastewater denitrification process <i>Marc Russenberger – The Univeristy of Auckland</i>
15:50 – 16:00	Closing remarks including poster session and gala dinner briefing <i>Robert Holt - Deputy Chair NZHS 2024, Callaghan Innovation</i>
16:00 – 17:45	Poster Session Icon Room – Level 2
18:45 – 19:30	Pre-dinner drinks and canapes Oceania Room – Level 3
19:30 – 22:00	Symposium dinner, including poster awards and guest speaker <i>Tina Schirr – Executive Director, BusinessNZ Energy Council</i> Oceania Room – Level 3

Friday 02 February 2024

## Session 1

**Chair:** Dr Suren Wijeyekoon | **Theme:** Hydrogen Production

9:00 – 9:10	Opening remarks <i>Prof Chris Bumby – Deputy Chair NZHS 2024, Paihau-Robinson Research Institute, Victoria University of Wellington</i>
9:10 – 9:45	<b>Plenary:</b> Advanced functional nanoporous materials for clean energy technologies <i>Prof Ajayan Vinu – Director GICAN, The University of Newcastle</i>
9:45 – 10:10	<b>Invited:</b> Biomimetic catalyst design strategy for sustainable green H <sub>2</sub> production <i>Prof Arnab Dutta – IIT Bombay</i>
10:10 – 10:25	Challenges and opportunities for green hydrogen production from water electrolysis <i>Prof Chuan Zhao – Univeristy of New South Wales</i>
10:25 – 10:40	Iridium-free anodes for proton-exchange water electrolysis <i>Prof Alexandr Simonov – Monash University</i>
10:40 – 11:05	Morning Tea

## Session 2

**Chair:** Dr Smrithi Talwar | **Theme:** Cross-cutting Topics

11:05 – 11:30	<b>Invited:</b> Te Mana O Te Wai: Relevance to a potential hydrogen industry for Aotearoa NZ <i>Dr Te Kīpa Kēpa Brian Morgan – Mahi Maioro Professionals</i>
11:30 – 11:45	Highly sensitive and selective hydrogen gas sensors employing photoactive hybrid nanomaterials <i>Prof Mahnaz Shafiei – Swinburne University of Technology</i>
11:45 – 12:00	Techno-economic feasibility of offshore wind farms for green hydrogen production: A case study from New Zealand <i>Dr Le Wen – The University of Auckland</i>
12:00 – 12:25	<b>Invited:</b> Exploring energy futures through green hydrogen's sociotechnical narrative <i>Dr Abbi Virens – University of Otago</i>
12:25 – 13:20	Lunch

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## Session 3

**Chair:** Dr David Dempsey | **Theme:** Hydrogen Storage and Distribution

13:20 – 13:55	<b>Plenary:</b> Hydrogen generation and storage: from materials to components <i>Prof Thomas Klassen – Director, Institute of Hydrogen Technology, Helmholtz-Zentrum Hereon</i>
13:55 – 14:20	<b>Invited:</b> Progress towards the ammonia-hydrogen economy <i>Prof Doug Macfarlane – Monash University</i>
14:20 – 14:45	<b>Invited:</b> Advancing the critical role of underground hydrogen storage in the energy transition <i>Jacqui Sutton – Lochard Energy</i>
14:45 – 15:00	Hydrogen migration within Earth <i>Dr Bhavik Harish Lodhia – CSIRO</i>
15:00 – 15:15	Grain refinement of Mg-RE based hydrogen storage alloys prepared by amorphous-crystallization technology <i>Prof Yiming Li – Inner Mongolia University of Science &amp; Technology</i>
15:15 – 15:30	Closing remarks, including site tours briefing <i>Dr Robyn Manuel – NZHS 2024 Organising Committee, Mahi Maioro Professionals</i>
15:30 – 16:00	Afternoon tea
15:30 – 19:00	Site tours



# Poster session

Thursday, 16:00 – 17:45

Please note the poster location ID numbers.

## Hydrogen production

1. Decarbonisation Hub: Powerfuels including Hydrogen Network  
*Thomas Gao – NSW Decarbonisation Innovation Hub*
2. Nano-catalytic surfaces prepared by ion-implantation for electrocatalytic hydrogen evolution  
*Niall Malone – GNS Science/The University of Auckland*
3. Development of photoanodes and proof-of-concept photoelectrochemical cell for green hydrogen production  
*Glen Mcclea – University of Canterbury*
4. Titanate photocatalyst/polyurethane foam composite for facile biohydrogen production via photo fermentation from corn stover  
*Yitbarek Fitwi Kidane – Myongji University*
5. Hydrogen evolution on a Pt single atom  
*Emily Wong – Victoria University of Wellington*
6. Biohydrogen and biomethane production from soluble wood sugars  
*Dr Suren Wijeyekoon – Scion*
7. Cyclic performance of iron ore-based oxygen carrier pellets using cement as the support during chemical looping biomass steam gasification for Hydrogen Production  
*Xueqi Zhang – University of Canterbury*
8. Determining the relationship between physical degradation and voltage decay of a proton exchange membrane electrolyser  
*Dr Jingjing Liu – The University of Auckland*
9. NiFeP<sub>x</sub> electrocatalyst: electrosynthesis, electro-activation, and applications in photo-electrocatalysis  
*Prof Chia-Yu Lin – National Cheng Kung University*
10. Mesoscale model for dissolution and coarsening of catalyst nanoparticles  
*Giovanna Bucci – Lawrence Livermore National Laboratory*
11. Efficient LDH materials for OER catalyst in direct seawater splitting  
*Dr Chang Wu – University of Canterbury*
12. Mapping nanobubble nucleation during oxygen evolution  
*Rizki Putri Andarini – Victoria University of Wellington*
13. Engineering defects in TiO<sub>2</sub> for the simultaneous production of hydrogen and organic products  
*Jiajun Zhang – University of New South Wales*

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14. Photo(electro)chemical valorization of organic waste over earth-abundant materials towards the production of hydrogen and formate

*Prof Yi-Hsuan Lai – National Cheng Kung University*

15. Enhanced photocatalytic H<sub>2</sub> production by matching blue edge with absorption edge in TaON photonic crystals

*Prof Toshihiro Moriga – Tokushima University*

16. Bio-inspired catalyst design strategy for green hydrogen production

*Santanu Ghorai – IIT Bombay*

17. Plasma mediated water splitting for hydrogen production

*Thomas Nott – GNS Science/Victoria University of Wellington*

18. Hydrogen generation from cyclic and acyclic carriers using 3D catalyst technology

*Dr Deepali Arora – CSIRO*

19. Advancing electrocatalysis: Impact of morphology on efficiency of electrocatalytic process

*Dr Ali Hosseini – CatalystTec*

20. Formulation and development of oxygen carriers for hydrogen production via chemical looping processes

*Dr Mohammad Nusheh – Hot Lime Labs*

21. Rapid prototype screening of bipolar plate flow geometries for AEM water electrolyzers

*Aaron Marshall – University of Canterbury*

22. Multiscale modeling of heterogeneous interfaces for hydrogen production

*Dr Anh Pham – Lawrence Livermore National Lab*

23. Oxygen nanobubbles under confinement

*Ghazaleh Ramezani – Victoria University of Wellington*

24. Copper- and Cobalt-based catalysts for photocatalytic hydrogen production

*Michael Bennington – University of Otago*

25. Effects of ion irradiation on molybdenum disulfide films for hydrogen evolution reaction

*Dr Peter Murmu – GNS Science*

26. Developing H<sub>2</sub> production catalysts by strategic installation of a synthetic cobalt core in protein scaffolds

*Abhishek Saini – Indian Institute of Technology Bombay*

27. A multidisciplinary approach to unravel the geologic hydrogen system in the Yorke Peninsula, South Australia

*Dr Julien Bourdet – CSIRO*

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## Hydrogen storage and distribution

28. Magnetocaloric properties of metal-substituted Ho-B alloys

*Dr Mahboobeh Shahbazi – Queensland University of Technology*

29. Metal energy carriers: using iron powder as hydrogen energy storage

*Helen Prime – Eindhoven University of Technology*

30. Multi-scale approach for deconvolution and quantification of the chemo-elastic energies within FeTi metal-hydride interphase from first principles

*Ebert Alvares – Helmholtz-Zentrum Hereon*

31. Electrochemical conversion of nitrate to green ammonia as an alternative hydrogen carrier

*Ming Zhang – University of New South Wales*

32. Boosting electrocatalytic nitrogen reduction for green ammonia generation

*Liam Anderson – Victoria University of Wellington*

33. Computational design of metal hydrides for hydrogen storage: From quantum effects to multi-scale simulations and machine learning

*Dr Kai Sellschopp – Helmholtz-Zentrum Hereon*

34. Carbon emissions of exporting hydrogen and ammonia from New Zealand to Japan

*Dr Arjan Abeynaike – University of Otago*

35. Synthesis of TiFe alloy for hydrogen storage applications by direct calciothermic reduction of ilmenite sand

*Mohammad Zarar – Robinson Research Institute, Victoria University of Wellington*

36. Utilization of LaNi<sub>5</sub> as a long-term hydrogen storage material for space applications

*Archa Santhosh – Helmholtz-Zentrum Hereon*

37. A molecular dynamics study of interfacial tension between gas mixture of H<sub>2</sub> and cushion gas with water under reservoir condition: Implications for underground hydrogen storage

*Dr Qiu hao Chang – University of Canterbury*

38. Multiscale modelling of doped TiFe for solid state hydrogen storage

*Lekshmi Dinachandran – University of Otago*

39. Porous materials for organic energy storage applications

*Benjamin Watts – Victoria University of Wellington*

40. Effects of catalysts on the capacities of HPSB hydrogen storage material

*Prof Zheng Xueping – Chang'an University*

41. Unlocking the potential hydrogen storage in Taranaki Field, New Zealand: Experimental program for Ahuroa cores

*Dr Runhua Feng – The University of Auckland*

42. Direct reduction of New Zealand sands to hydrogen storage material

*Alexander Haack – Helmholtz-Zentrum Hereon*

43. Effect of Ilmenite reduction pathway on TiFe hydrogen storage properties obtained by Sieverts apparatus measurement

*Matthieu Ramond – University of Otago*

44. Mapping formic acid oxidation across platinum grain boundaries

*Hannah Summers – Victoria University of Wellington*

45. Effect of mechanical alloying on phase synthesis and hydrogen absorption/desorption behavior of (TiV)<sub>50</sub>(CrMnFe)<sub>50</sub> alloys

*Yutao Zhai – The University of Waikato*

46. Synthesis, characterization, and properties of powder metallurgy transition metal-based high entropy alloys for electrocatalytic application

*Prof Fei Yang – The University of Waikato*

47. Novel Nanoporous Composites for Hydrogen Storage

*Hugh Davies – University of Bath / Monash University*

## Hydrogen utilisation

48. Driving the transformation to hydrogen ironmaking: An experimental vertical shaft H<sub>2</sub>-DRI reactor facility at Robinson Research Institute

*Dr Ben Yin – Robinson Research Institute, Victoria University of Wellington*

49. Boosting electrochemical CO<sub>2</sub> reduction in MOFs via enhancement of mass and charge transport

*Shae Patel – Victoria University of Wellington*

50. Catalytic hydrogen elimination technology and research progress of catalysts for hydrogen combustion

*Liu Yong – University of Science And Technology Beijing*

51. Reduction of iron-oxide fines using hydrogen

*Dr Conrad Hessels – Eindhoven University of Technology*

52. Hydrogen reduction of raw and pre-oxidised NZ titanomagnetite ironsands in a small-scale high-temperature fluidised bed

*Bavinesh Maisuria – Robinson Research Institute, Victoria University of Wellington*

53. Can hydrogen be economically feasible in decarbonising Australian steelmaking?

*Aditiya Harjon – University of Technology Sydney*

54. Electrochemical testing in gas diffusion electrode (GDE) half-cells: Bridging the gap between model thin film and realistic fuel cell operation conditions

*Anouk Soisson – University of Bayreuth*

55. Electro-catalytic CO<sub>2</sub>RR by immobilizing molecular complexes onto a carbon support

*Varinder Singh – University of Otago*

56. Initial investigation into the in-flight reduction of New Zealand ironsand

*Gabrielle Hunter-Smith – Robinson Research Institute, Victoria University of Wellington*

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57. Optimal numerical methods for computational fluids dynamics models of proton exchange membrane fuel cells

*Hamish Edwards – Deakin University*

58. Testing of molecular catalysts for homo- and hetero-geneous HER and CO<sub>2</sub>RR

*Kieran DeMonte – University of Otago*

59. Kinetic analysis of zinc metal production using low concentration hydrogen

*Dr Shanghai Wei – The University of Auckland*

60. Pelletization and induration of New Zealand titanomagnetite ironsand for hydrogen direct reduction

*Shaira Mendoza – Robinson Research Institute, Victoria University of Wellington*

61. Modular microfluidic fuel cell platform based on lego-on-a-disc

*Jacob Oliver – The University of Waikato*

## Hydrogen energy systems

62. Fast power regulation method of electrolytic hydrogen production load based on silicon controlled rectifier with power electronic on-load-tap-changing switches

*Dr Xin Meng – Sichuan University*

63. Demand response algorithms for industrial green hydrogen production

*Isaac Severinsen – The University of Auckland*

64. Transformation pathways towards a climate neutral European energy system using integrated power and gas networks

*Manuel Wetzel – German Aerospace Center (DLR)*

65. Multi-period feasibility study of green hydrogen supply network in decarbonising New Zealand's industries

*Daniel Jia Sheng Chong – University of Waikato*

66. Learning from 100 papers: Challenges and trends for distributed hydrogen systems

*Akash Jyoti Handique – University of Canterbury*

67. A practical demonstration of hydrogen supplementing a standalone renewable energy system

*Robert Holt – Callaghan Innovation*

68. Demand response operation of distributed green hydrogen electrolysis for industrial applications

*R. Michael Kalpagé – The University of Auckland*

## Cross-cutting topics

69. Does the growing H<sub>2</sub> economy pose a risk to the environment?

*Dr Bill Trompetter – GNS Science*

70. Exploring green hydrogen's place in the green future of Aotearoa, New Zealand: Perspectives from Southland

*Zion-Elijah Davis – University of Otago*

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71. Development of a lab-scale plant for renewable energy and hydrogen research  
*Dr Christopher Harrison – Swinburne University of Technology*

72. Mauri Model decision making framework: How to incorporate measurement of Te Mauri O Te Wai and an appreciation of infrastructure belonging  
*Dr Te Kīpa Kēpa Brian Morgan – Mahi Maioro Professionals*

73. Demand scenarios for hydrogen transition in New Zealand: Priorities and expectations  
*Hadi Vatankhah Ghadim – University of Canterbury*



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