NARVIN DAVID NEEHALL
11 Old Tarouba Road, St. Clements, San Fernando Trinidad and Tobago, W.I.
(E-mail) narvin_neehall@hotmail.com (C) +1 868 476-9340

EXPERIENCE (Research Activities)

8 Feb. 2024 - Present
Break in Research
- Health and well-being.

17 Oct. 2022 - 8 Feb. 2024
Research Scientist- ACS
National Research and Development Institute for Cryogenic and Isotopic Technologies (ICSI), Ramnicu Valcea, Romania
- Development of Anode-Free Sodium-ion Batteries.
- Development of LNMO-graphite coin and pouch cells.
- Cathode and anode formulation and coating using a pilot-scale line.
- Conducted material characterisation of battery components using advanced techniques.
- Engineered a hollow-core fibre optic Raman probe for operando studies of electrolyte in battery pouch cells.
- Modified Hiden Analytical Quadrupole Mass Spectrometer for precise in-situ gas evolution monitoring.
- Facilitated collaboration with external vendors for efficient equipment installation.
- Actively participated in conferences and workshops for professional development.
- Contributed to research proposals for grants.
- Published as an author and co-author in international scientific journals.

Projects (Energy Storage):

- **New insights towards next-generation of Na-ion/metal batteries - ToNaBatt-** To develop sustainable high energy density sodium batteries utilising materials and methods that avoid toxic reagents and solvents, and to minimise the carbon footprint of battery production by employing eco-friendly chemical techniques - role: **Research Member** – focus on cycling protocols of anode-free sodium half cells.

- **Hybrid electrodes with mixed energy and power performance for next-generation lithium-ion batteries-Hydra2020**- To create Generation 3b lithium-ion batteries (free of cobalt) that offer rapid charging, high power output, and extended cycle life, using production methods that are both environmentally friendly and cost-effective- role: **Research Member-** focused on developing in-situ/operando based experiments (MS and Raman) for monitoring battery pouch cells; cathode and anode slurry formulations, coin and pouch cell fabrication.

11 Oct. 2021 – 16 Oct. 2022
Break in Research
- Actively seeking employment which was secured in May 2022; however, due to visa processing issues could only start in Oct. 2022.

10 Oct. 2020- 10 Oct. 2021
Associate Professional Programme – Ministry of Education, Port-of-Spain, Trinidad
University of Trinidad and Tobago (UTT), Pt. Lisas Campus
- Led additive manufacturing research on biomass additives in polymers.
- Conducted experimental design, process optimisation, and data analysis in additive manufacturing.
- Contributed to sustainable manufacturing methods and environmentally-friendly materials.
- Led development of local bio-based materials database.
- Facilitated informed decision-making and promoted sustainable materials adoption in manufacturing.

NARVIN DAVID NEEHALL

11 Old Tarouba Road, St. Clements, San Fernando Trinidad and Tobago, W.I.
(E-mail) narvin_neehall@hotmail.com (C) +1 868 476-9340

- Co-supervision of PhD student with academic supervisor.

EDUCATION AND QUALIFICATIONS

15 May 2015- 18 Dec. 2019 (Awarded May 26, 2020)
Ph.D. Mechanical Engineering *Thesis: Through-plane Gas Permeability of Carbon-Based Porous Media in Polymer Electrolyte Fuel Cells (PEFCs)*
University of Sheffield, Sheffield, United Kingdom
PhD Supervisors: Dr Kevin Hughes (University of Sheffield, UK)
Dr Mohammed Ismail (University of Hull, UK)

27 Sept. 2012- 27 Sept. 2013 (Awarded 18 Nov. 2013)
MSc. Energy and Sustainability with Electrical Power Engineering *Thesis: Arc-discharge synthesis of Graphene*
University of Southampton, Southampton, United Kingdom: **Grade: Distinction**

10 Aug. 2006- 15 May 2010 (Awarded 15 May 2010)
BSc. Electrical Engineering
Florida Institute of Technology, Melbourne, Florida, USA: **Grade Point Average: 3.68 (Honours)**

PUBLICATIONS

- N.D. Neehall, M.S. Ismail, K.J. Hughes and M. Pourkashanian, "Effect of Microporous Layer Ink Homogenisation on the Through-Plane Gas Permeability of PEFC Porous Media," *Energies*, vol. 16, no. 16, p. 5944, Aug. 2023, doi: 10.3390/en16165944

  The study examines the impact of different microporous layer ink homogenisation techniques on the gas permeability and morphology of PEFC gas diffusion media. For microporous layers made with low-surface-area carbon (Vulcan XC-72R), magnetic stirring significantly increases gas permeability compared to bath sonication, without affecting surface morphology. In contrast, for high-surface-area carbon (Ketjenblack EC-300J), the homogenisation technique has little effect on gas permeability but noticeably alters surface morphology, with bath sonication creating smoother surfaces and magnetic stirring producing more cracks. Extending the sonication time to three hours further reduces gas permeability for microporous layers made with Ketjenblack EC-300J.

- N.D. Neehall, M.S. Ismail, K.J. Hughes, and M. Pourkashanian, "Effect of composition and structure of gas diffusion layer and microporous layer on the through-plane gas permeability of PEFC porous media," *Int. J. Energy Res*., vol. 45, no. 15, pp. 20988–21005, 2021, doi: 10.1002/er.7158.

  The study investigates how the composition and structure of gas diffusion media affects gas permeability. It was found that gas diffusion layer and type of carbon powder used in the microporous layer influences the permeability, with low-surface-area carbon forming denser layers and high-surface-area carbon creating rougher, more cracked layers. Generally, permeability decreases as carbon loading increases, but the effect varies depending on the gas diffusion layer structure. Additionally, increasing polytetrafluoroethylene content in the gas diffusion layer significantly reduces permeability with low-surface area carbon powder, but has little effect when using high surface area carbon powder.

- N.D. Neehall (PhD. Dissertation), "Through-plane gas permeability of carbon-based porous media in polymer electrolyte fuel cells," 2019, https://etheses.whiterose.ac.uk/26987/.

NARVIN DAVID NEEHALL

11 Old Tarouba Road, St. Clements, San Fernando Trinidad and Tobago, W.I.
(E-mail) narvin_neehall@hotmail.com (C) +1 868 476-9340

CONFERENCES AND SEMINARS

- N.D. Neehall, A.S. Zaulet, C.G. Ungurueanu, A. Rizoiu and M.R. Buga, "Analysis of the Evolved Gases in a Multi-Layer Lithium-Ion Battery Pouch Cell after Extensive Cycling," XXIVth International Conference, New Cryogenic and Isotope Technologies for Energy and Environment, Baile Govora, Romania, Oct. 18-20*, EnergEn 2023 Book of Abstracts*, Page 105-106, ISSN (print): 2601-9965.

  There have been rarely any mass-spectrometry studies which utilised large format LIB pouch cells, many of which mainly focused on single-layer pouch cells. A multi-layer lithium nickel manganese oxide (LNMO) cathode - graphite anode pouch cell was constructed. The multi-layer pouch cell was subsequently cycled, and the gases evolved after extensive cycling are extracted ex-situ and injected into a mass spectrometer to determine the composition of the gases. Findings agree with the literature, for a similar electrolyte but different electrodes Nickel Manganese Cobalt (NMC), whereby carbon dioxide and methane are the predominant gases after 1000 cycles for the 4.8 V cut-off voltage.

- C. Ungureanu, N.D. Neehall, A. Rizoiu, A. Chitu, A. Spinu-Zaulet, N.C. Felix, S. Fantini, A. Vlad, S. Clark and M.R. Buga, "Cycling Stability of High-Voltage Spinel Cathode LNMO in Lithium-Ion Pouch Cells Employing Carbonate Based Electrolytes," XXIVth International Conference, New Cryogenic and Isotope Technologies for Energy and Environment, Baile Govora, Romania, Oct. 18-20, *EnergEn 2023 Book of Abstracts*, Page 89-91, ISSN (print): 2601-9965.

  The manufacturing and characterisation of high-voltage spinel cathode $LiNi_{0.5}Mn_{1.5}O_4$ – graphite Li-ion pouch cells were conducted, with their electrochemical performance evaluated using carbonate-based electrolytes and additives within a voltage range of 3.0-4.9V. The Li-ion pouch cells demonstrated improved electrochemical stability at high voltage during long-term cycling, maintaining 75% capacity retention after 2500 cycles at 1C, with no gas evolution related to electrolyte decomposition at high voltage, and achieving an average coulombic efficiency of 99.97%.

- N.D.Neehall and M. R. Buga, "In-Situ Raman Spectroscopy of Rechargeable Battery Electrolytes," XXIVth International Conference, New Cryogenic and Isotope Technologies for Energy and Environment, Baile Govora, Romania, Oct. 18-20, 2023 [Poster Presentation].

  A portable Raman probe was adapted with hollow-core fibre optics specifically for operando studies of electrolytes within battery pouch cells, aiming to enhance real-time analysis and understanding of electrolyte dynamics during battery operation. The probe was designed and fabricated using a metal-lined, high-quality hollow-core optical fibre, ensuring efficient light transmission with minimal signal loss and providing high sensitivity and resolution. The system was constructed with a custom-built gas-tight cell block featuring an optical window, allowing for precise laser interaction with the fibre optic cable while protecting the pouch cell from exposure to the ambient environment. The probe's accuracy was validated through rigorous calibration against standard and electrolyte solutions.

MEMBERSHIP & AWARDS

2014-2019

- Recipient of Post Graduate Scholarship 2014 from the Government of Trinidad and Tobago (Full Tuition and Monthly Maintenance: ca. £100,000).

NARVIN DAVID NEEHALL

11 Old Tarouba Road, St. Clements, San Fernando Trinidad and Tobago, W.I.
(E-mail) narvin_neehall@hotmail.com (C) +1 868 476-9340

2012-2013

- Recipient of the Development Needs Scholarship 2012 from the Government of Trinidad and Tobago (Full Tuition and Monthly Maintenance: ca. £30,000).

2006-2010

- Dean's List (Florida Institute of Technology).
- Partial Academic scholarship awarded from Florida Institute of Technology (US$40,000).

2006-2014

- Member, IEEE

SKILLS

- Battery Fabrication (coin, pouch)
- Glovebox experience
- Raman spectroscopy
- Scanning electron microscopy (FE-SEM/EDS)
- Mechanical material property testing (Universal Test Machine)
- Mass spectrometry
- Electrochemical characterisation (GCD, CV, EIS, LV, GITT, LSV, OCV)
- Design of experiment (DOE)
- COMSOL Multiphysics
- Matlab & Simulink
- OriginPro
- Microsoft Office

LANGUAGES

- English (Native)
- Spanish (Intermediate)
- Italian (Basic)
- Romanian (Basic)

REFERENCES

- Dr. Mohammed Ismail, Senior Lecturer, University of Hull, (e) m.s.ismail@hull.ac.uk (c) +44 1482 465071
- Dr. Amalia Soare, Senior Researcher, National Research Institute for Cryogenic and Isotopic Technologies (ICSI), (e) amalia.soare.icsi.ro (c) +40 740033955
- Dr. Kevin Hughes, Senior Lecturer, University of Sheffield, (e) K.J.Hughes@sheffield.ac.uk (c) +44 1142157214