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National Science and Technology Forum (NSTF)

media release

International Battery Day, 18 February 2025

Prof Emmanuel Iwuoha proposes lithium-ion batteries as an alternative energy source

South Africa (SA) has been grappling with an energy crisis for several years, enduring load-shedding for over 16 years. Batteries play an important role in addressing the country's energy challenges. They store and release energy, power devices, and help manage the energy grid. Batteries are a key component in the transition to renewable energy sources and a more sustainable future.

The International Battery Day is celebrated on 18 February to honour the birth of Alessandro Volta, the Italian physicist and chemist who invented the first practical battery in 1801. The National Science and Technology Forum (NSTF) spotlights the remarkable award-winning research of **Prof Emmanuel Iwuoha** that achieved ground-breaking disease diagnostic sensor devices, lithium-ion battery/supercapacitors, and solar cell technology for use in sensors and clean energy generation. Prof Iwuoha is the SARChI Chair for Nano Electrochemistry and Sensor Technology at the University of the Western Cape (UWC). He received the prestigious 2024 Engineering Research Capacity Development Award of the NSTF-South32 Awards, known as the 'Science Oscars' of SA. (SARChI = South African Research Chairs Initiative established in 2006 by the Department of Science, Technology and Innovation – DSTI, and the National Research Foundation – NRF).

Caption: Prof Glenda Gray, Prof Iwuoha (holding Award), Dr Ulrich Minnaar (Distribution Research Solutions Manager at Eskom Holdings) and Mr Mmboneni Muofhe (Deputy Director-General: Socio-economic Innovation Partnerships, DSTI)

About International Battery Day: Volta's battery in 1801 was a simple yet groundbreaking invention. He stacked a series of silver (or copper) and zinc discs, placing them between pieces of leather (or cardboard) soaked in saline to conduct electricity. This day celebrates the development of batteries, and their subsequent role in powering our world and accelerating decarbonisation efforts. His invention, known as the voltaic pile, was the very first device that could provide a steady, lasting current of electricity, paving the way for countless advancements in science and technology. Batteries power an abundance of devices in our lives, from recreational toys and devices to important medical equipment, modern culture relies and thrives on the power that batteries provide.

More about Prof Iwuoha: Prof Emmanuel Iwuoha is the recipient of the Engineering Research Capacity Development Award at the 2024 NSTF-South32 Awards held on 11 July 2024. His work pushes boundaries in functional materials and nano-electrochemistry while fostering a new generation of researchers and innovators. His research also involves creating functional materials from sustainable resources like solar cells, batteries and supercapacitors for use in sensors and clean energy generation.

Prof Iwuoha was elected a Fellow of the Royal Society of Chemistry (RSC) of the United Kingdom (UK) in 1999. He is an exceptional electrochemist with more than 25 years of experience in the development of smart materials (polymeric, dendritic, graphitised nanotubes, composite materials for application in the construction of sensors, reactors and energy-generating systems).

He is also the Founder and Director of SensorLab (UWC Sensor Research Laboratories) since 2002. The SensorLab is his crowning achievement which began with only one MSc student in a small laboratory but is now a centre of excellence comprising 11 state-of-the-art laboratories, 65 postgraduate students and 12 academic staff members. Over the past 22 years of the facility's existence it has enabled training of over 200 postgraduate students and postdoctoral fellows. This growth led to the building of the new state-of-the-art Chemical Sciences Building at UWC, which includes SensorLab. Prof Iwuoha emphasises the importance of developing adequate research facilities. He states: "Aspiring researchers should aim for adequate research infrastructure and laboratories suitable for in-house implementation of research plans."

Prof Iwuoha's research activities in the electrochemical beneficiation of platinum group metals (PGMs) comprises developing new-generation nanoalloys and quantum dots (tiny nano particles) for harnessing in clean energy production (in lithium-ion battery cathodes, supercapacitors and photovoltaic cells), sensor fabrication and the development of luminescent, light-emitting diodes and thermo-chromic devices (which change colour with changes in temperature).

The broader context of Prof Iwuoha's research is poised to address the increasing global energy demand and the need for renewable energy sources, such as wind and solar, to replace fossil fuels. However, renewable energy generation is intermittent, requiring effective energy storage systems such' as lithium-ion batteries. A lithium-ion battery (LIB/Li2MnO3) is an advanced battery technology that uses lithium ions as a key component of its electrochemistry. The manganese oxide cathode material of rechargeable Li2MnO3 presents an attractive alternative due to its low cost, non-toxicity, and high theoretical capacity, though it faces challenges such as low conductivity and capacity fading. Prof Iwuoha's research proposes Doping with Europium (Eu) as a method to enhance its electrochemical performance, by increasing their discharge capacity, stability, and conductivity. Europium is a rare earth element with good electrical conductivity and chemical stability, thereby contributing to the development of more efficient energy storage materials. The Li2MnO3 stored energy produced by renewables and fed into the grid coud play a huge role in reducing the shortfall in electricity supply and contribute towards enabling long-term energy security, which is especially necessary in SA, to combat rolling blackouts.

Prof Iwuoha's biggest wish is for his work to transcend the academic space and trickle down to improve the quality of life in rural African communities by developing low-cost solar cells and disease diagnostic tests. This underscores his commitment to translating cutting-edge research into practical solutions. He concluded: "I've always been driven to find ways that could benefit humanity or offer solutions to real-world problems."

The annual NSTF-South32 Awards, known as the 'Science Oscars of SA', are the largest, most comprehensive, and most coveted national recognition in the field. They have been held since 1998 to honour outstanding contributions to science, engineering, technology (SET), and innovation by individuals, teams, and organisations across SA.

About the NSTF (National Science and Technology Forum): NSTF is an independent non-profit stakeholder body and network – a civil-society forum of over 140 organisations in SET and innovation in SA.

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References/Sources:

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- National Battery Day (February 18th) | Days Of The Year
- Celebrating International Battery Day | GP Batteries HK
- Prof. Emmanuel Iwuoha - UNNRG
- Department of Chemistry People | UWC
- Nano Transition Metal Alloy Functionalized Lithium Manganese Oxide Cathodes-System for Enhanced Lithium-Ion Battery Power Densities | Semantic Scholar

About the NSTF

The National Science and Technology Forum (NSTF), established in 1995:

- is a broadly-representative stakeholder body for all science, engineering and technology (SET) and innovation organisations in South Africa
- gathers stakeholders around burning issues of national and global interest, across the public and private sectors, including matters of public policy
- includes a network of professional societies in SET and STEM education (STEM = science, technology, engineering and mathematics) - the NSTF pro*SET* membership sector.
- recognises, awards and profiles the outstanding contributions of individuals and groups to SET and innovation through the prestigious NSTF Awards
- runs and supports collaborative projects and youth outreach, including recognition of top performance in mathematics and science, role modelling, bursary and STEM career information
- runs and supports the STEMulator.org which attracts youth and educators to Explore>Discover>Learn the world of STEM including careers. (Established by NSTF pro*SET)*

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www.nstf.org.za
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