
Researchers Modify Hybrid Flow Battery Electrodes with Nanomaterials

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Researchers in WMG at the University of Warwick, in collaboration with Imperial College London, have found a way to enhance hybrid flow batteries and their commercial use. The new approach can store electricity in these batteries for very long durations for about a fifth the price of current technologies, with minimal location restraints and zero emissions.

The researchers enhanced three hybrid flow cells using nitrogen doped graphene (exposed to nitrogen plasma) in a binder-free electrophoresis technique (EPD).



Wind and solar power are increasingly popular sources for renewable energy. Unfortunately, intermittency issues keep them from connecting widely to the National grid. One potential solution to this problem involves in the deployment of long-duration battery technology, such as the redox flow battery. Despite its great promise the current costs of this system are a key determining factor to real-world adoption. An affordable grid battery should cost £75/kWh, according to the US Department of Energy. Lithium-ion batteries, which lead the charge for grid storage, cost about £130/kWh.

Now WMG researchers have found a way of enhancing hybrid flow batteries or regenerative fuel cell (RFC) technology that could store electricity for very long durations for about one-fifth the cost of current storage technologies, with flexibility in siting and with minimal environmental impact. The technology combines carbon-based electrodes with economically sourced electrolytes, (manganese or sulphur, which are abundant chemicals in the planet) by means of a simple and yet highly effective electrophoretic deposition of nano-carbon

additives (nitrogen-doped graphene) that enhance the electrode durability and performance significantly in highly acidic or alkaline environments.

The researchers have published their [findings](#) in a paper entitled, 'Hybrid Redox Flow Cells with Enhanced Electrochemical Performance via Binderless and Electrophoretically Deposited Nitrogen-Doped Graphene on Carbon Paper Electrodes' in the December 2020 edition of the journal ACS Applied Materials & Interfaces.

Dr Barun Chakrabarti, a Research Fellow in WMG at the [University of Warwick](#) and one of the lead authors on the paper said:

"This EPD technique is not only simple but also improves the efficiencies of three different economical hybrid flow batteries thereby increasing their potential for widespread commercial adoption for grid-scale energy storage."

The hybrid flow battery's total chemical cost is about 1/30th the cost of competing batteries, such as lithium-ion systems. Scaled-up technologies may be used to store electricity from wind or solar power, for multiple days to entire seasons, for about £15 to £20 per kilowatt hour. These batteries are also extremely useful for grid-scale load levelling applications as their design is very flexible due to their unique feature of sizing their power independently of their energy.

The energy density of a hybrid flow battery, especially the polysulphide/air system (S-Air), is 500 times higher than pumped hydroelectric storage. It is also so much more compact and can be placed near any renewable generation.

Read the [original article](#) on University of Warwick.