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The role of nanostructured catalysts for low cost and long life electrochemical energy storage systems for CO_2 mitigation and integration with a potential hydrogen economy

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Abstract

Redox flow batteries are a valuable energy storage technology for electric grid applications, because their power and energy can be sized independently. This becomes particularly important when storage times of several hours are required. They can also operate over a wide range of states of charge, which means that they impose less constraint on the electric grid in terms of the required control strategy. Work by Nigel Brandon [Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future by Strbac, et al., Energy Futures Lab, Imperial College 2012] has shown the need for such forms of energy storage for future low carbon energy systems, and has quantified the value to the overall electricity system in terms of reduced investment and operating costs, with system savings of £10bn/year possible through the application of storage technologies for some high renewable scenarios by 2050. An EPSRC funded project led by Brandon in collaboration with China's Dalian Institute of Chemical Physics has provided valuable data in this regard [UK research needs in grid scale energy storage technologies by Brandon, Chakrabarti, et al., SUPERGEN Hub White Paper 2017]. Therefore at the heart of this presentation is the development of improved and lower cost flow batteries for grid scale storage applications for CO2 mitigation strategies. I will discuss our role in developing novel nanostructured membrane-electrode assemblies (MEAs) to catalyse hydrogen-based flow chemistries. I am looking at harnessing waste biomass as source for such MEAs and I will show how our novelty is scalable at potentially lower cost to MW/MWh systems. Finally, I will touch upon how such systems may be integrated with a potential hydrogen economy by working in tandem with pumped hydro and compressed air energy storage systems to bring a green revolution for future generations.

Biography

Barun Chakrabarti has completed his PhD at the age of 25 years from Manchester University, UK. He is a research engineer and co-advisor to the Board of RFC Power (an Imperial College London spin out based in the Department of Earth Science and Engineering), UK. He has over 50 publications that have been cited over 3000 times, and his publication H-index is 26 and has been serving as an editorial board member of reputed Journals.

Publications

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3. Charge/discharge and cycling performance of flexible carbon paper electrodes in a regenerative hydrogen/vanadium fuel cell, INTERNATIONAL JOURNAL OF HYDROGEN ENERGY, Vol: 44, Pages: 30093-30107, ISSN: 0360-3199
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5. Screening of effective electrolyte additives for zinc-based redox flow battery systems, JOURNAL OF POWER SOURCES, Vol: 412, Pages: 44-54, ISSN: 0378-7753

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