Research Proposal Seminar On Aqueous Redox Flow Battery

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Abstract:

Redox flow batteries (RFBs) are highly efficient electrochemical energy storage (EES) devices for large-scale electricity generated from renewable energy sources like solar, wind etc. The energy-power decoupling makes the RFBs unique from other EES devices. Vanadium redox flow battery (VRFB) is one of the most studied RFB due to its several advantages, e.g. long cycle life, avoidable cross-contamination of electroactive species, safe to use etc.[1] Electrodes plays a significant role in VRFB which provides a suitable site for the electrochemical reactions that in turn decides the performance of the battery. Graphite felt (GF) and carbon paper (CP) are the most common electrode material for VRFB. Due to hydrophobicity and less electroactive surface area of these electrodes, it is necessary to activate the electrodes and/or coat suitable electrocatalyst for better performance of the battery.[2] Thermal activation[3] and sulfuric acid[4] activation are the widely accepted methods for such electrodes. A lot of electrocatalysts such a carbon material, metal, metal oxides etc. have also been studied.[5] Still, there is a lot more scope to increase the energy efficiency (EE), electrolyte utilization, cycle life of the VRFB.

On the other hand, commercialization of VRFB is limited by its high cost. About 35-50 % of its cost is from its active material, i.e. vanadium due to its scarcity.[6] Hence, the cost of the battery can be minimized by replacing vanadium using organic electroactive species. Quinone based electroactive species are widely studied for organic aqueous flow batteries. However, they face many challenges related to side reactions, instability, low solubility etc.[7]

In this seminar, a literature survey on electroactive materials for various aqueous acidic RFBs and my work on VRFB will be discussed.

References:

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