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## Design and applications of redox active materials for advanced rechargeable batteries

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Redox flow battery (RFB), as one of the most promising technologies for large-scale stationary energy storage up to MW (power) or MWh (energy), has attracted increasing attention from both academic and industrial research groups. RFB is characteristic of many attractive advantages including decoupling of energy storage and power output, exceptional design flexibility, excellent scalability and modularity, long service life, high efficiency, etc. These technic merits make RFB a well-suitable choice to stabilize the power grid and overcome the intermittency of renewable energy sources (solar, wind and hydroelectricity etc.). Traditional aqueous RFB (ARFB), although with a number of technic advantages, is primarily limited by low energy density due to the narrow operation voltage confined by water electrolysis and low concentrations of redox components. To circumvent the limitations of the ARFB system, we have initiated research on non-aqueous redox flow battery (NARFB) employing redox active organic and hybrid organic/inorganic molecules as flowable electrode materials.

In this presentation, we will report our new results on synthetic design and modification of ferrocene based and other advanced redox active complexes in order to optimize operating redox potentials and increase concentrations (i.e. volumetric energy density). Electrochemical performance of the new electrode materials for RFB will be discussed to highlight research and development of RFB at PNNL and address future research directions. In addition, recent advance of electrolyte materials for other battery systems will also be highlighted.

### Biography

Tianbiao Leo Liu received his PhD from Texas A&M University in 2009 and currently he serves as a staff scientist at Pacific Northwest National Laboratory. His research is broadly spread on energy and green chemistry including electrocatalysis, electrochemical energy storage and environment benign chemical transformations. Dr. Liu is a leading chemist on the development of low cost electrocatalysts for electrochemical energy conversions and a pioneer on multi-valent rechargeable batteries. He has published more than 30 papers in reputed journals and 4 patents.

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