# *Particle Dispersion Flow Batteries*

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Flow batteries are energy storage devices often considered a hybrid between a battery and a fuel cell. While operation relies on reversible electrochemical redox reactions, the electroactive material is dissolved or dispersed in a liquid phase that can be stored in external tanks. This flexibility enables decoupling of the power and the energy in the design of a flow battery device. Classic flow batteries have relied on transition metals dissolved in acidic aqueous solutions as the redox active species that undergo electrochemical reactions to deliver/store energy. The energy density of these classic systems is limited by both the solubility of the transition metals in the solvent as well as the electrochemical stability window of the aqueous electrolyte.

Recent progress has been made in research on flow batteries that have the electrochemical energy stored in solid particles, as opposed to dissolved transition metals. These solid particles do not have the solubility limitations of the dissolved transition metals because they are already active materials in the solid phase, and through selection of the appropriate chemistry can have potentials that exceed those of the classic flow battery systems. Unfortunately, most of the explored systems rely on slurries with interconnected conductive additives that provide excellent electrical conductivity but extremely high viscosities which will reduce the overall energy efficiency of the system through parasitic pumping costs. This work will describe preliminary efforts towards a flow battery system with solid particles that are not within an interconnected slurry, but instead rely on collisions with a current collector to deliver and store electrochemical energy. The coupling between electrochemical and rheological properties within this system results in unique tunability of the properties of the electrolyte fluids.