

Improving the performance of solid boosters in flow batteries

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Aqueous flow batteries are promising approach for large-scale stationary energy storage, but storage capacity is limited by solubility of the redox active species. The capacity can be increased by incorporating solid redox active materials into the tanks as solid boosters. Now, the solids are charged or discharged in a chemical reaction with the flow battery electrolyte.

We have investigated ferri/ferrocyanide electrolyte coupled with Prussian Blue in different conditions in the lab scale. We will discuss how modifying the experimental conditions allows achieving >70% utilization of the solid capacity. However, the system performance was still limited by slow charging/discharging of the solid. To better understand the limiting processes, we have utilized finite element modelling considering both the flow battery cell and the tank filled with solids to evaluate how different parameters affect the system performance and how the solid materials should be selected and formulated to reach high capacity utilization also at high current densities. The model was first validated against experimental data. Better capacity utilization can be obtained with increasing residency time of the electrolyte and decreasing the size of the solid particles.