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SYMMETRIC ELECTROCHEMICAL CELLS IN NONAQUEOUS ORGANIC REDOX FLOW BATTERIES – APPLICATIONS FOR LONGEVITY STUDY

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Redox flow batteries (RFBs) are a promising technique to address the need for renewable energy storage due to their decoupling of power and capacity. Specifically, nonaqueous RFBs are advantageous due to their wide potential windows, making high energy densities achievable. Further, nonaqueous solvents allow for the use of a wide range of cheap, abundant organic redox-active molecules as electroactive species. However, crossover of these redox-active molecules results in permanent contamination and capacity decay, preventing their widespread application. Bipolar redoxmers (BRMs), single molecules that can be used as both anolyte and catholyte resulting in a symmetric RFB, are a promising solution to address this challenge. To evaluate their hypothesized benefits, systematic analysis of BRMs in battery performance (e.g., solubility, electrochemical reversibility and stability, crossover) was conducted through electrochemistry and spectroscopies and compared to solutions containing the identical active components but as mixed, separate species. This work lays the foundation for a new battery principle, which may greatly improve the longevity of flow batteries.