**OBJECTIVE AND SIGNIFICANCE:** Optimization of battery electrodes to improve performance by tuning architecture.

**BACKGROUND:** Today advanced energy conversion devices typically rely on composites electrodes made of several materials interacting with one another. Understanding their individual and combined impact on performance is essential in the pursuit of an optimized systems. Unfortunately, this investigation is often disregarded in favor of quick publishable results. In this project we used Designs of Experiments as a suitable set of statistical tools to optimize formulations and to investigate the importance of parameters in a process while minimizing resources. Defining the optimal formulation for a given set of electrode components is tedious, time consuming and will seldom lead to publication. Defining new approaches to minimize work and time to reach an optimal battery electrode composition is highly beneficial to the field. To this end, we used a Design of Experiments (DoE) approach based on a mixture design which was applied for the first time to the electrode formulation field in open literature. Consequently, the relationship between electrode composition, microstructure and electrochemical performance was uncovered on known and novel materials.

This approach is applied to two types of electrodes: high power electrodes for lithium batteries (ORN funded, in collaboration with the University of Montreal) and sodium intercalation electrodes (DOI funded, in collaboration with Trevi Systems and the University of Nantes) to investigate the feasibility of desalination batteries. Research conducted for this project is completed in the **PakaLi Battery Laboratory**.

**PROJECT STATUS/RESULTS:** Ongoing project. A high power battery system was optimized in collaboration with the University of Montreal. This work led to two publications so far, including the one listed below.


**Funding Source:** Office of Naval Research; U.S. Department of Interior via Trevi Systems

**Collaboration:** University of Montreal (Canada), University of Nantes (France)

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