

**ABSTRACT - POSTER****Fully Integrated Autonomous & Chemistry Agnostic Materials  
Acceleration Platform for Sustainable Batteries**

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The demand for next-generation batteries for electric vehicles, grid-scale storage, and other applications requiring high-energy-density batteries continues to grow. The current development process, driven by trial and error, intuition, and heuristics, is very inefficient, costing a lot of time and money and resulting in a product taking about 20 years to reach the market. A solution to this process is the creation of a Fully Integrated Autonomous & Chemistry Agnostic Materials Acceleration Platform (FULL-MAP).

FULL-MAP tends to rely on intelligence rather than intuition. With the help of modeling and AI tools, new materials can be designed that already account for environmental and economic factors, which are important factors in battery development. Using this strategy, durable, sustainable, and cost-effective next-generation batteries should reach the market about 5 times faster. The FULL-MAP strategy encompasses autonomous characterization and validation, enabling a materials mass production and increasing the efficiency of its development. These mass-produced materials are to be manufactured automatically, e.g., in test cells, enabling high-throughput testing.

As tomorrow's batteries need to be cost-effective and sustainable, disordered rock salts (DRXs) are a promising candidate. DRXs can serve as active materials with high energy densities (over 200 mAh/g), competing with state-of-the-art NMC-type materials. Additionally, they can be composed of Earth-abundant elements such as Mn and Ti, making them also more sustainable. The crystal lattice of a DRX consists of a cubic structure (Fm-3m), similar to NaCl, where every anion is surrounded by six cations and every cation is surrounded by six anions. Additionally, the cations are randomly distributed along the cationic sites (they are disordered). In this project, a DRX will be synthesized containing Li, Mn, and Ti cations, with oxygen as the anion ( $\text{Li}_{1+x}\text{Mn}_{1-3x}\text{Ti}_{2x}\text{O}_2$ ). Currently, DRXs are synthesized via solid-state synthesis, which poses challenges for upscaling. To enable easier scale-up, DRXs were chosen to be synthesized via solution-gel-based synthesis followed by thermal treatments. Based on key parameters such as phase purity after synthesis and electrochemical performance in a lithium-ion battery, the best are selected for high-throughput testing.