Docket #: S17-408

Autonomous Screening and Optimization of Battery Formation and Cycling Procedures

Optimizing battery performance currently relies on empirical testing using arbitrary parameters, under-validated physiochemical models, and limited data analysis of summary trends. The Chueh lab at Stanford utilized closed loop optimization to develop an adaptive optimal experimental design algorithm capable of reducing battery development time by up to two orders of magnitude. For each cell in a 48-cell array, the OED algorithm analyses data from the first 100 cycles to predict the cell lifetime. Once there is enough data to predict with sufficient confidence, the OED determines the next cycling parameters for an individual cell and sends them to the potentiostat before repeating the process. As the 48 cells are tests in parallel, what is typically a 560-day process to evaluate 224 charging protocols only takes 16 days. This technology applies to fast charging, formation protocols, and state-of-health monitoring for overall lower development cost and time.

Stage of Research

- Proof of concept

Applications

- **Battery design optimization**
- Example processes: fast charging, formation cycling, state-of-health monitoring

Advantages

- **Accelerates battery development times by up to two orders of magnitude**

- Algorithm determines testing parameters and duration without the need for manual optimization

Publications

- Attia et al. Nature (2020) Closed-loop optimization of fast-charging protocols for batteries with machine learning

Patents

- Published Application: 20190115778
- Issued: 10,992,156 (USA)

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