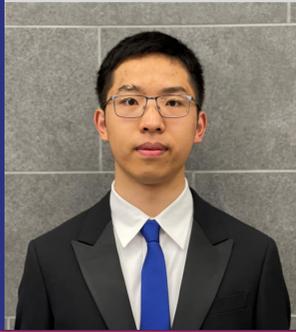


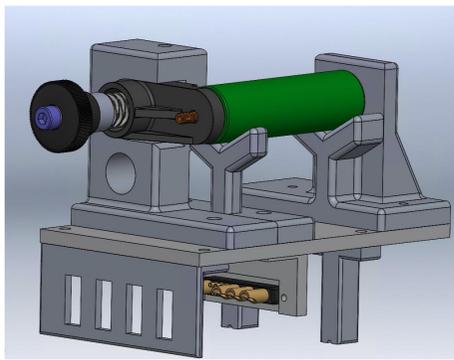
An Innovative Design of the Battery Test Fixture



Ningyuan Fu supervised by Tom Cleaver and Ismail Mossallam

Abstract

Battery testing is crucial to examine the safety and performance of cells. However, very few suitable battery fixtures exist on the market. The aim of this 10-week internship was to design a new battery test fixture to be used in the company's testing lab, and possibly sell as a product in the future. This fully-functioning prototype used some of the main concept designs from the latest battery testing technology: CellPods from Cognition Energy Ltd. This fixture is designed specifically for 21700 cells, but can also be easily adapted for other cell sizes.



CAD Model of the Prototype



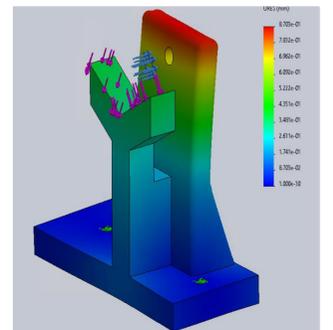
CellPods Stand

Motivation

- The company is expanding its capacity in battery testing. However, the current battery fixtures are either too expensive or of poor quality.
- Key design goals include:
 - Low contact resistance
 - A repeatable, reliable and easy way to load and unload the cells
 - Safety (Electrical, fire)
 - Can fit in all the connectors required for testing
 - Adaptable to the cyclers and thermal chambers in the company's testing lab

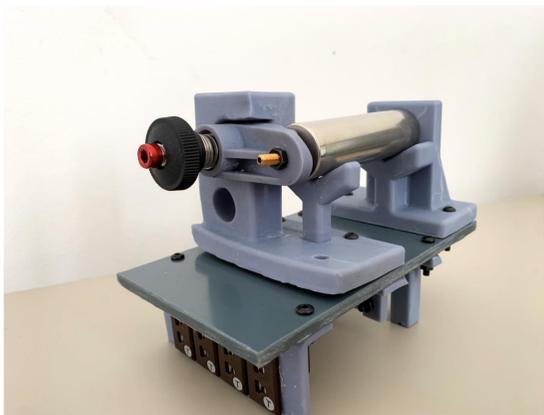
Methods

- Used Solidworks CAD to model and design the fixture
- Finite Element Analysis on the fixture to make sure it can withstand the 60N compression from the thumbscrew
- Resin-printed the initial design and developed it further to finally assembled a fully-functioning prototype



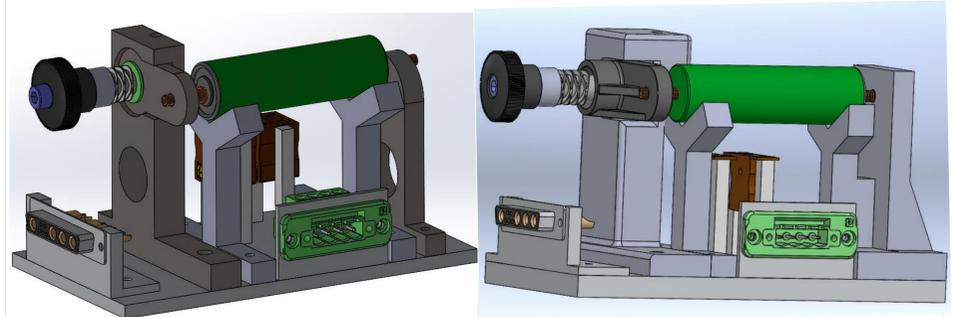
Highlights of the Fixture

- Simple and reliable battery testing of up to 60A
- Fit perfectly into the company's existing thermal chambers (Binder KB115)
- Compact and easy to use (No tool required to load and unload cells)
- The thermocouple panel can be easily switched into panels of other connector types, therefore adaptable to various cycler brands.
- Remove the need for complicated and bulky cable routing.
- Maximised airflow around the cell

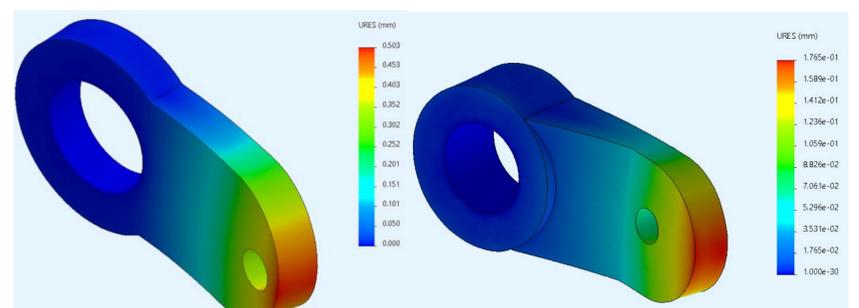


Design Journey

- Getting to know the pain point of using off the shelf battery test fixtures
- Choice of the fixing mechanism for the cell: the mechanism used in CellPods is chosen for its proven simplicity and reliability.
- Material selection: the two ends of the fixture have to withstand up to 60N in a temperature range of -20 to 70 °C)
- Connector selection: considering the size, availability and ease of use for different connectors on the market
- The packaging problem: how to fit everything on a very compact base plate whilst leaving enough space for the power and sensor cables



Two previous versions of the design

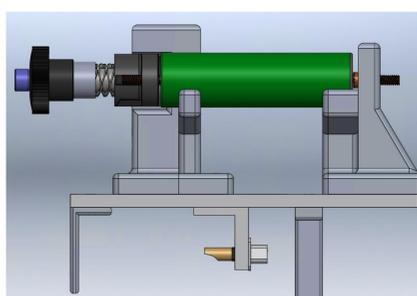


An example of design iterations: Reducing the contact shoulder's deflection caused by compression

A Comparison of the final design (left) with a previous one (right)

Impact / Next steps

- Redesign to aid manufacturing and reduce the cost
- Test in the company's battery testing lab and improve its performance
- Modification of the design to fit other cell sizes



Side View of the Prototype

Intern bio

Ningyuan Fu is a Mechanical Engineering student from Imperial. With just one year left for his undergraduate studies, he seeks to further his study in the field of engineering as well as gain more practical experience in the industry. Within mechanical engineering, his particular interest lies on thermofluids and structural analysis.

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