Universität Stuttgart
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MA / FA /BA

Investigation of the Relationship Between Electrode Material Expansion and State of Charge (SoC) in case Using Confocal Sensor

The goal of this thesis is to study the relationship between the expansion of electrode materials and the battery's state of charge (SoC) using an optical sensor. Confocal sensors provide high-precision, non-contact measurements of distance and surface profiles by using focused light and detecting the reflected signals. This makes them ideal for capturing the subtle expansion of electrode materials during cycling. Their ability to deliver real-time, high-resolution data on displacement is important for this study.

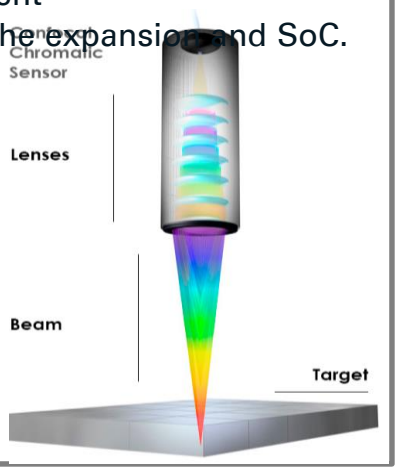
This study involves setting up an experimental system of confocal sensors to measure changes in electrode thickness in real time within a transparent case. The system will detect and analyze the electrode's expansion with varying SoC, converting optical signals into displacement data. By understanding how electrode materials behave under different charge states, this research will provide valuable insights for improving battery design and optimization.

Tasks:

- Learn how confocal sensors work and how they can be used for measuring distances.
- Design and construct the experimental setup using a transparent glass cylinder with the assistance of a 3D printer and custom-built components.
- Set up the sensor system and ensure it is properly aligned with the battery
- Physical translation of optical signals into displacement
- Analysis of the data to understand the link between the expansion and SoC.

Requirement:

- Interest in sensor technology and measurement equipment
- Basic knowledge of mechanical engineering or battery technology
- Good teamwork skills and self-reliant work style
- Enthusiasm in lab work
- Experience in design like Solidworks or Fusion360 is advantageous



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