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Onboard early detection and mitigation of lithium plating in fast-charging batteries

Stanford scientists have invented an inexpensive device to detect the first signs of lithium plating during fast-charging of lithium ion batteries, enabling early onboard detection of this issue during battery development or use.

Widespread adoption of electric vehicles requires faster charging to make fueling up more convenient for consumers. When a battery charges at a high current, like when an electric vehicle is rapidly charging, lithium metal deposits on the battery anode in a process called lithium plating, accelerating the battery's failure. Current detection of lithium plating involves invasive methods, fails to detect plating at its earliest stage, and/or does not allow detectors to reside onboard the battery and report on plating in real time.

This technology consists of an inexpensive device which detects lithium plating at its onset. The high sensitivity of the device promises faster R&D of battery technologies that attempt to address the issue of lithium plating. Additionally, since the device can be installed onboard a battery and communicate with its management system, engineers can include it in production batteries, where it will allow charging current to be adjusted to mitigate plating early. This technology represents a key innovation in the future of fast-charging batteries and next-generation battery health monitoring.

Applications

- **Accelerated Research & Development**: Early, non-invasive detection of lithium plating in lithium-ion batteries speeds up the development cycle for fast-charging battery solutions

- **Onboard Monitoring & Early Mitigation**: Detect lithium plating and communicate with the battery management system to dynamically extinguish plating and ensure safe fast charging

Advantages

- **Inexpensive**: Uses a relatively inexpensive differential pressure sensor
- **Non-invasive**: Monitor onset of lithium plating without destruction of battery
- **High sensitivity**: See lithium plating at its onset so it can be mitigated
- **Novel Onboard Application**: Coordinate detection with battery management system to dynamically adjust current and mitigate lithium plating before system failure

Patents

- Published Application: WO2022006214
- Published Application: 20230246254
- Issued: 12,744,259 (USA)

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