

BATTERY SEPARATOR TECHNOLOGY



DETECTING DENDRITE GROWTH WITHOUT NEGATIVE IMPACTS ON PERFORMANCE

Large-format lithium ion batteries are known to be susceptible to fire. Failures in batteries start locally, but the tools used to assess battery performance and health are global, so they detect a problem only when it is too late to prevent a fire.

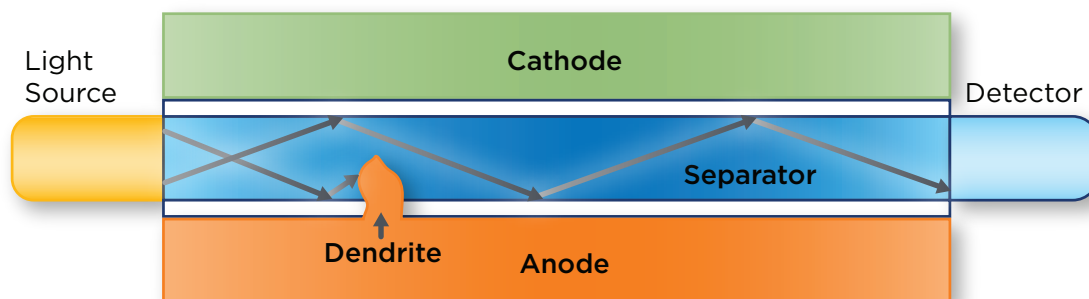
Battelle developed a sensor that can detect the onset of faults at a local level during charging and use in manufactured batteries.

OUR TECHNOLOGY

A major cause of catastrophic battery failure is the growth of dendrites (metal particles that grow from one electrode and span the gaps between electrodes to cause a short circuit). In a standard battery, there is a separator between electrodes that helps prevent short circuits. Battelle's technology uses the battery separator as an optical waveguide. We insert light into one side of the separator and monitor the transmission of light on the other side. If a dendrite begins to grow, the transmission of light changes, indicating the dendrite's presence.

This is the first technology able to provide local detection of dendrites in an operating battery. Today, checks are performed by checking the voltage of a whole battery cell. This does not get to the local areas of interest.

The key element to making this concept work is having the electrolyte with a refractive index close the separator. We have demonstrated this technology using electrolytes and separator materials that are readily available. With these, we have demonstrated the ability to detect the growth of dendrites. Using the separator as a sensor has shown no negative impact on battery performance.



CURRENT STATE

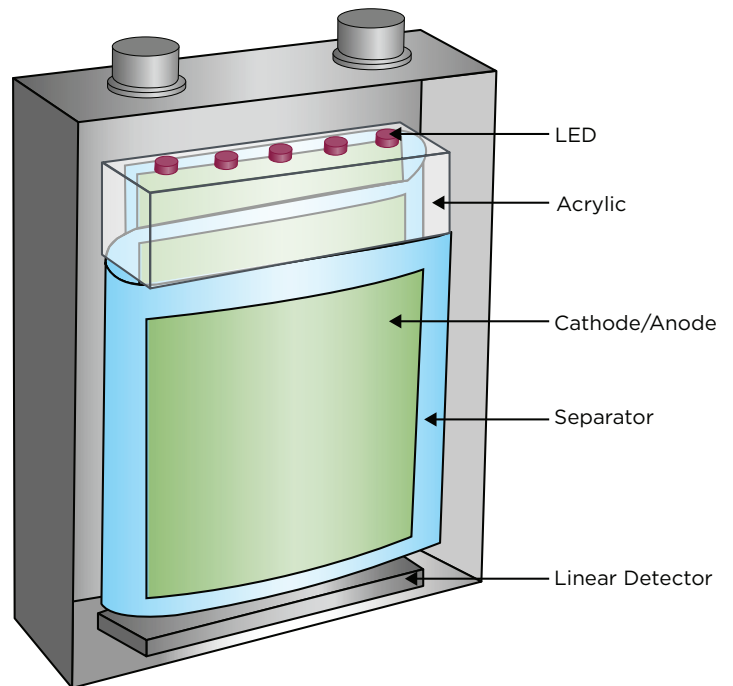
Battelle's battery separator has been developed to a Technology Readiness Level 4. We have demonstrated success to date using open-cell batteries. The next step in advancing the technology is to demonstrate it in a fully packaged battery.

Based on manufacturing conversations and assessments, we believe this technology could be included for less than a 10% increase in battery cost. This small increase in cost will also allow for the operation of the battery across a wider range of state of charge, which will increase battery utilization for longer run times and use life. Having the sensor included may reduce the amount of additional safety elements needed in the overall system and potentially lower total system costs.

The current sensor is not retrofittable. It needs to be manufactured into the battery during fabrication.

FUTURE USES

A key feature of this technology is that it is not restricted only to lithium ion batteries. The emerging high-energy density, lithium-sulfur battery chemistry and the future lithium air battery chemistry are challenged by the growth of dendrites. Battelle's separator technology be easily incorporated into both these battery chemistries to ensure safe operation of the batteries that will store even more energy than lithium ion batteries.



Every day, the people of Battelle apply science and technology to solving what matters most. At major technology centers and national laboratories around the world, Battelle conducts research and development, designs and manufactures products, and delivers critical services for government and commercial customers. Headquartered in Columbus, Ohio since its founding in 1929, Battelle serves the national security, health and life sciences, and energy and environmental industries. For more information, visit www.battelle.org.

800.201.2011 | solutions@battelle.org | www.battelle.org

Battelle and its logos are registered trademarks of Battelle Memorial Institute. © Battelle Memorial Institute 2019. All Rights Reserved.

ID 682 05/19

BATTELLE
It can be done