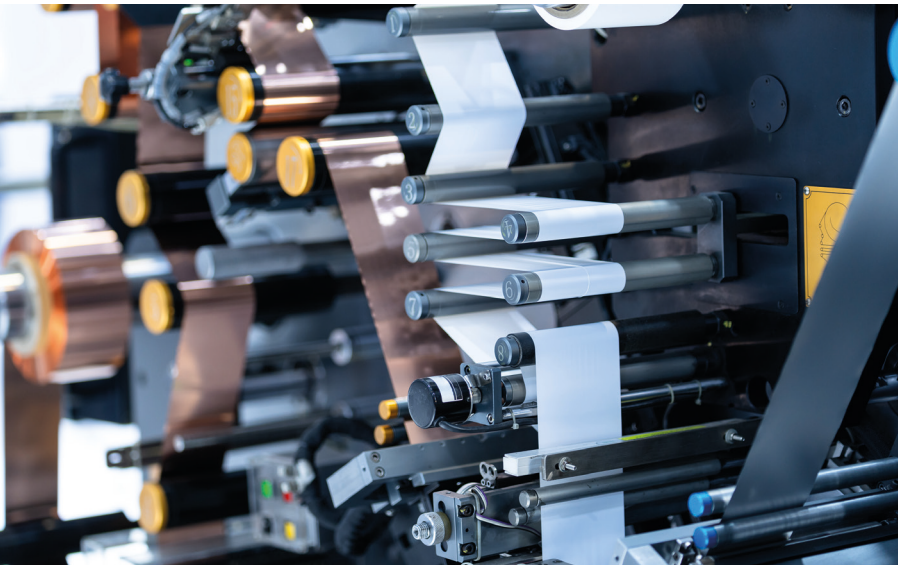
ABB MEASUREMENT & ANALYTICS | APPLICATION NOTE

Take control of separator manufacture in battery production

Optimize production efficiency, battery quality and safety with ABB's robust, calibration-free tension measurement solutions



ABB's proven tension measurement technology delivers reliable performance in tough settings

Measurement made easy

Introduction

Lithium-ion battery manufacturers are currently looking to ramp up production and drive down costs while maintaining high levels of quality and safety. In such a competitive and demanding manufacturing environment, even small improvements in performance can make a big difference.

The battery market is booming as the world transitions towards more sustainable energy systems. The roll-out of electric vehicles and other electrification efforts are pressing ahead, while consumer electronics such as laptops, tablets and smart watches remain in high demand. Rechargeable, lightweight, energy-efficient and boasting a high energy density, lithium-ion batteries play an important role in all these technologies, with many forecasters predicting that market growth will top 25 percent per year.

Separators are essential battery components that can have a significant influence on battery quality, efficiency and service life, so separator production is a critical step in battery production.

Separators consist of thin, porous membranes that physically separate the cathode and anode electrodes in a battery cell while allowing the passage of ions between them during the charge and discharge cycles.

Application

Separator films help ensure the proper functioning and safety of the finished battery by preventing direct contact between the electrodes while enabling the movement of ions.

The process of creating a battery separator includes several sequential steps. The base separator film is manufactured in either a wet process or a dry process resulting in a polyethylene and/or a polypropylene film, in one or several layers. The aim is to create a strong uniform film with consistent porosity, pore size, and thickness that is free from wrinkles or other flaws. Most often the base film is subsequently coated with a slurry based on a ceramic substrate to increase its thermal stability and thus the safety of the battery.

Challenge
When manufacturing separators for battery production, there are several physical characteristics that must be tightly controlled to deliver the battery performance and longevity the market demands.

Separators need uniform porosity to permit consistent ion transport while maintaining the physical integrity of the barrier between the electrodes. They must also be of uniform thickness to prevent local hotspots and uneven distribution of the electrolyte within the battery cell. Similarly, any wrinkles and other defects can affect their integrity and potentially cause short circuits or mechanical failure.

The tension of the separator membrane plays a key role in determining all these characteristics, so accurate tension measurement is important to optimize these properties and improve the efficiency, life cycle and safety of the finished battery.

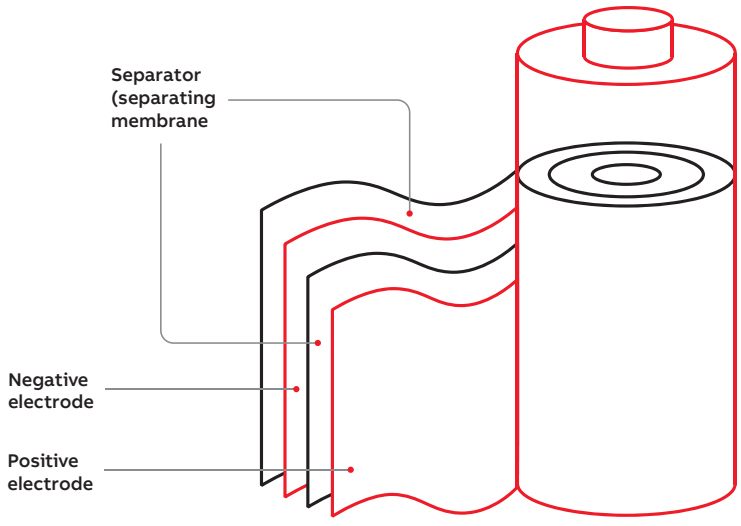
Tension measurement and control also helps manufacturers to optimize their production process by ensuring the separator material is stretched consistently, allowing them to increase throughput and reduce waste.

Solution
The answer is to provide accurate, effective tension measurement throughout the manufacture of the separator film. However, maintaining the accuracy and reliability of measurement systems can be challenging in a demanding factory environment, where equipment can be subject to physical vibration and impact forces.

Satisfying the rapidly escalating demand for batteries calls for production lines that can operate with minimal downtime, so pausing production to calibrate or service measuring devices is potentially a problem. The need for calibration can halt production for several hours at a time, with further delays introduced by factors such as difficulty in accessing machinery.

In tension measurement applications, for example, typical load cells based on strain gauge and LVDT (Linear Variable Differential Transformer) technologies can be impacted by factors such as vibration, unexpected shock loads, electrical interference and incorrect specification and installation. This can increase the frequency of calibration and/or recalibration, perhaps putting the production line out of service for several hours while the work is carried out.

These issues can be successfully overcome by opting instead for devices that rely on technologies that can function for long periods of time without drift or loss of calibration.



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Structure of a lithium battery.

What can ABB offer?

Building on years of experience gained in the tough environment of the metals and paper industries, ABB's proven tension measurement solutions deliver accurate and reliable performance throughout their operational lifetimes in the most challenging industrial settings. This makes them ideal for use in battery production facilities.

Combining electronics with high-accuracy ABB Pressductor load cells, our tension measurement solutions provide high-accuracy tension control. By maintaining a constant tension within the desired range, regardless of any acceleration or deceleration, they maintain quality and minimize the risk of stoppages caused by torn or broken separator membranes.

Pressductor load cells are sensitive and accurate yet rugged, reliable and compact. They are impervious to difficult factory conditions, such as high overloads and vibrations.

That's because they rely on a measurement principle based on the magnetoelastic effect, whereby the magnetic properties of a material are influenced by the mechanical force applied to it. This makes Pressductor technology extremely robust and reliable, with no drift and no need for recalibration.

A complete measurement solution for battery manufacture
Separator manufacture is just one of several steps in battery production that calls for high-precision measurement and control. ABB offers a complete set of measurement solutions for high-quality, efficient and safe battery production.

To find out more about ABB's solutions, contact your local representative, or visit **https://new.abb.com/products/measurement-products/industry-and-application/battery**

Tension measurement

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