Battery separator has indentation

Why is the mechanical integrity of battery separator important?
The mechanical integrity of battery separator is critical for prevention of internal short circuit. A better understanding of the mechanical behavior and failure mechanisms of the separators may assist in explaining an apparently conflicting response.

Why is separator integrity important in lithium-ion batteries?
Separator integrity is an important factor in preventing internal short circuitin lithium-ion batteries. Local penetration tests (nail or conical punch) often produce presumably sporadic results,where in exactly similar cell and test set-ups one cell goes to thermal runaway while the other shows minimal reactions.

Can a lithium-ion battery separator be abused?
The separator may go under this kind of loading in most real world mechanical abuse scenarios. It represents combined in-plane biaxial tension and out-of-plane compression. A punch test with a small radius punch head is one of the standard abuse tests for lithium-ion battery separators.

How does nanoindentation affect a battery?
Nanoindentation,on the other hand,determines the mechanical properties(elastic modulus and hardness) of separators on length scales comparable to typical sizes of active material particles in battery electrodes or metal fines that can ingress a battery during manufacturing.

How do micropores affect a lithium-ion battery separator?
The micropores of the separator have a significant influence on the obstruction of the electrode active material particles at the initial stage and on the micro particles that may enter the lithium-ion battery during the manufacturing process, which may cause damage to the weak point of the separator.

How strong is a lithium ion battery separator?
According to the requirements of the United States Advanced Battery Consortium (USABC) for lithium-ion battery separators,the specifications of separators immersed in liquid electrolyte are >300 g/25.4 um puncture strength and <2% offset at 1000 psitensile strength.

The compression of the separator was found to adversely influence the charging performance of the Li-ion battery. When the compression ratio reaches 40 %, the charging ...

We conducted an experimental study of the separators under mechanical loading, and discovered two distinct deformation and failure mechanisms, which could explain the ...

It remains a challenge to fully understand the nature of the mechanical damage process with the aim of improving battery crash safety. The present paper investigates the ...

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From a two-dimensional electrochemical simulation of a spherical indentation on a layer-structured battery, it is found that there is local negative value of the side reaction ...

However, a comprehensive understanding on micro deformations in separator structure and failure mechanisms in more realistic loadings like punch indentation is still missing.

Finally, the study found that every 20% change in SOC has a greater impact on the battery response under a squeeze. The larger the SOC, the more severe the battery thermal runaway.

This review summarizes and discusses lithium-ion battery separators from a new perspective of safety (chemical compatibility, heat-resistance, mechanical strength and anti-dendrite ability), the ...

2.2 Jellyroll Compression Tests. Jellyrolls extracted from the cells were subjected to the uniaxial compressions in the thickness direction at various strain rates ranging from 9 × 10 -4 /s to 657/s. Compression tests for strain rate tests up to 9/s were conducted in the constant speed mode using an MTS machine (Criterion (R) Series 40) equipped with a 100 kN load cell.

It has been found that the separators that underwent higher cycles failed at lower lateral punch force and smaller deformation. Live cell tests also indicate that the deformation and force intensity at the onset of short circuit decreased for a cell after 1200 cycles compared to those for a non-cycled cell, when under lateral indentation.

In this study, a nanoindentation experiment is performed to investigate the mechanical properties of two types of separators for LIBs based on the grid nanoindentation ...

However, when considering sphere indentation and flat-headed indentation, some deviations emerge between the simulation results for separators with different thicknesses and the experimental data, with the exception of the favorable agreement observed for the 7.9 um thick separator (Fig. 10 b-c). This divergence can likely be attributed to the larger contact area ...

Punch test results for separators with different punch size. (a) Punch diameter: 25.4 mm. (b) Punch diameter: 12.7 mm. (c) Punch diameter: 6.4 mm. (d) Punch diameter: 3.175 mm. (e) Normalized ...

pressure from a localized indentation in the battery surface. At the same time, efforts to develop lithium-ion battery cells that offer improved performance characteristics and that are smaller and lighter in weight have also resulted in major modifications in battery separators and other essential battery materials. For example, the use of a ...

It is evident that these existing studies only considered the effects of relatively small compression of the separator on electrochemical performance (35 MPa in Ref. [18], 25 MPa in Ref. [21], 40 ...

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The significance of the reliability of battery separators has recently attracted attention because of the safety related events such as the Boeing 787 Dreamliner battery incidents and Samsung"s Galaxy Note 7 incidents and subsequent recall. ... The indentation induced internal short circuit (IIISC) test is used to evaluate the cell"s ability to ...

Experimental work The battery cells in this study had an elliptical shape and a nickel oxide chemistry. The dimensions were 64.8 mm by 37.2 mm by 19.1 mm and their nominal capacity was 5.3 A h.

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