Investigating Barrier Properties of Laminate Packaging Materials for Flexible Batteries

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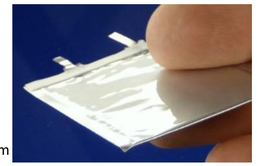
Introduction

Flexible batteries are used in wearables such as health monitoring devices, skin sensors, and flexible electronics.

These batteries are made with sealed flexible packaging material which undergo constant bending.



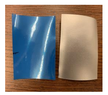
https://www.powerstream.com/thin-lithium-ion.htm

Research Questions

What is the effect of grain orientation of the seal strength?
What is the effect of the adhesive, tab, and electrolyte exposure on the seal strength?
How does the seal strength change after bending?

Analyzed Material

Name: A
Thickness: 0.148 mm



Name: B
Thickness: 0.087 mm

Methods

1. Cut the samples into the desired dimensions

Sheet Grain Direction

Horizontal **Vertical**

Sheet Grain Seal Orientation:
HH: Both horizontal
VV: Both vertical
VH: 1 vertical & 1 horizontal

Methods

2. Prepared two adhesive tapes and the tab

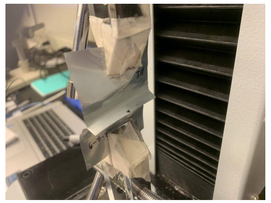
3. Sealed samples

Adhesives were added between the sealing area to secure the tab used for electrical connections to the battery electrodes.

4. Bending machine or electrolyte addition

Angle: 60˚ **Cycles:** 3,000

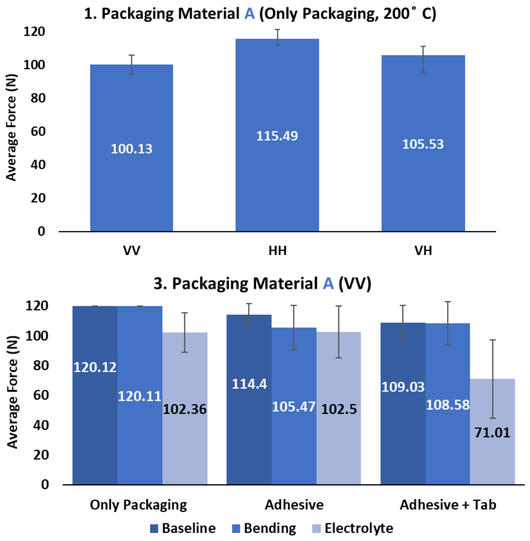
5. Tensile tester

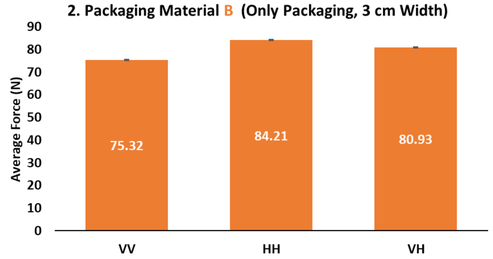


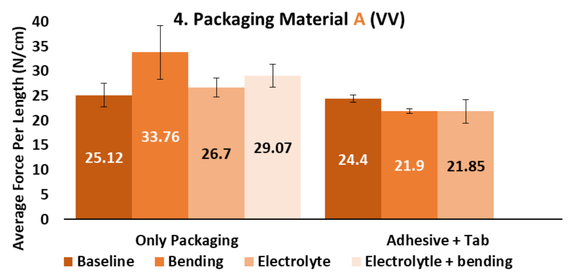
Sample dimensions:
A: 5 cm x 4 cm
B: 2.5 or 3 cm x 4 cm

Cross-section view

Results







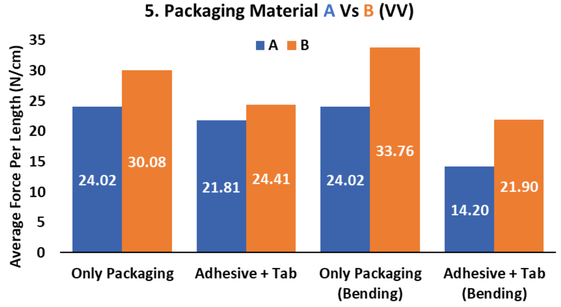


Figure 1 & 2 : The average max force of packaging materials A & B at different orientations.
Figure 3 & 4: Seal strength of A & B with its different conditions
Figure 5 : Comparison of average force per length rate of material A & B with its different conditions

Conclusion

HH had the highest seal strength in both Material A and B. Material A's seal strength decreased when adding adhesive + tab. It also decreased slightly with bending but decreased the most with electrolyte addition. Similar trend occurred in Material B except the seal strength increased in bending. Material B's seal strength is higher in all conditions when compared to Material A.

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FURI

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