

Battery Tab Selection for Pouch Cells: Aluminum vs Nickel, 5 mm vs 8 mm

How to choose the right battery tab material and width for your pouch cell research: aluminum for cathodes, nickel for anodes, and when the 5 mm or 8 mm width makes a difference.

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What Is a Battery Tab?

A battery tab (also called an electrode tab or current lead) is the metallic strip that connects the electrode current collector inside a pouch cell to the external terminals. When you charge or discharge your cell, all current flows through the tab. That makes the tab a surprisingly critical component: it must form a reliable weld to the current collector, maintain low contact resistance over thousands of cycles, and seal hermetically where it exits the pouch film.

For research groups fabricating custom pouch cells, tab selection comes down to two choices: **material** and **width**.

Material Selection: Why Aluminum for Cathodes, Nickel for Anodes

Battery tabs are not interchangeable between electrodes. The material is chosen to match the current collector metal, and that choice is driven by electrochemistry.

Aluminum Tabs for the Positive Electrode (Cathode)

Aluminum is the universal current collector material for lithium-ion cathodes. The reason is thermodynamic: at cathode operating potentials (typically 3.5–4.2 V vs Li/Li⁺), aluminum forms a stable passive oxide layer that prevents dissolution. Copper, by contrast, oxidizes and dissolves above about 3.4 V, which is why it cannot be used at the cathode.

When you connect an aluminum tab to an aluminum current collector, you get a **same-metal weld**—the interface resistance is low, and there is no risk of galvanic corrosion between dissimilar metals. Using a nickel or copper tab on an aluminum current collector creates a bimetallic junction that, over many cycles, can develop increasing contact resistance and mechanical delamination.

Aluminum tabs in this kit are **99.5% purity or higher**. For most cathode chemistries (NMC, LFP, NCA, LCO), this purity level is appropriate. Higher purity grades are available for research that specifically requires minimizing trace metal contamination.

Nickel Tabs for the Negative Electrode (Anode)

The negative electrode current collector in lithium-ion cells is copper foil. Copper is used here because it is stable at anode potentials (0–1.5 V vs Li/Li⁺), where aluminum would alloy with lithium.

Nickel tabs are used at the anode rather than copper tabs for practical reasons: nickel is easier to ultrasonically weld in thin foil form, it is chemically compatible with the copper current collector through the nickel-copper weld interface, and it is more resistant to the corrosive environments that can occur near the pouch seal where residual electrolyte and moisture may be present. Nickel is also compatible with the nickel-plated surfaces commonly found on current collector tabs and bus bars in battery test fixtures.

Nickel tabs in this kit are **99.6% purity or higher**.

One Common Mistake to Avoid

Never use an aluminum tab on the anode or a nickel tab on the cathode. The weld quality will be poor (dissimilar metal welding in thin foil is unreliable without specialized tooling), and the electrochemical compatibility is wrong. The aluminum-tab-on-anode mistake is particularly common when researchers are assembling their first pouch cells and have extra aluminum tabs from cathode fabrication.

Width Selection: 5 mm vs 8 mm

Both widths serve the same functional purpose. The right width depends on your electrode geometry and the current load you need to carry.

Current Carrying Capacity

Tab resistance scales with cross-section. At 0.1 mm thickness (the standard for both widths in this kit), the cross-sectional area of a 5 mm tab is 0.5 mm² and of an 8 mm tab is 0.8 mm². The larger tab carries 60% more current at the same resistive heating.

For research cells running at low C-rates (C/5 or lower), the difference in resistive heating between 5 mm and 8 mm tabs is negligible. At C-rates of 1C or higher—or for rate capability studies—the 8 mm tab is the more appropriate choice. A tab that runs noticeably warm during discharge is a sign that tab resistance is contributing meaningfully to your voltage measurements.

Electrode Width Constraints

The practical constraint for most research cells is the electrode strip width. The tab must be fully welded to the current collector without overhanging the electrode edge, and the sealing tape must fully cover the tab where it exits the pouch film.

For a 30–40 mm wide electrode strip (typical for small research pouch cells), a 5 mm tab leaves adequate clearance and is easy to position reliably. For electrode strips wider than 60 mm, the 8 mm tab is more appropriate to keep tab resistance proportional to the current density.

If you are unsure, **start with 5 mm**. It is the more commonly used width in academic research cells and the dimensional tolerance is easier to manage by hand.

The Sealing Tape

Each kit includes polyimide (PI) sealing tape. The tape width is matched to the tab width in every pack: 0.5 cm tape with 5 mm tabs, 0.8 cm tape with 8 mm tabs.

Polyimide was chosen deliberately over cheaper alternatives:

- **Thermal stability:** rated to 300°C, well above the heat-sealing temperature of most aluminum laminated films (160–200°C). PET tape, by contrast, can soften and deform during heat sealing.
- **Chemical resistance:** stable in contact with standard carbonate and ether-based electrolytes. PVC and PE tapes can swell or degrade.
- **Electrical insulation:** the tape provides the dielectric barrier between the tab metal and the metallic (aluminum foil) layer inside the pouch film at the seal line.

How to Apply the Sealing Tape

Wrap the tape symmetrically around the tab at the position where the tab will exit the pouch film. The tape should:

- Cover both the top and bottom face of the tab at the exit point
- Extend 2–3 mm onto the tab on each side of the seal line
- Lie flat without wrinkles (wrinkles create leak paths)

Apply moderate finger pressure before heat sealing to pre-conform the tape to the tab geometry. During heat sealing, the tape softens slightly and bonds to the inner PP layer of the pouch film, forming the hermetic seal around the tab exit.

Welding the Tab to the Current Collector

The standard method for attaching aluminum and nickel tabs to foil current collectors in research settings is **ultrasonic welding**. The kit does not include solder; soldering is not appropriate for thin current collector foils in battery applications because:

- The heat from soldering can locally damage the electrode coating
- Lead-free solder forms a brittle intermetallic with aluminum
- Flux residues are ionic contaminants that degrade electrolyte stability

For small-scale research cells, desktop ultrasonic spot welders are available starting from approximately \$300–500 (commonly used in academic labs: Sunstone, Amada Miyachi, or similar). Key parameters for aluminum tab-to-foil welding: amplitude ~30–50 μm , weld force 0.2–0.5 N/mm^2 , weld time 100–300 ms.

If ultrasonic welding equipment is not available, resistance spot welding (for nickel tabs to nickel-plated copper foil) is an alternative for the anode side. Aluminum resistance welding is more difficult and generally requires higher-end equipment.

Specifications Summary

Parameter	Value
Tab dimensions	0.1 mm × 5 mm × 50 mm or 0.1 mm × 8 mm × 50 mm
Aluminum purity	≥ 99.5%
Nickel purity	≥ 99.6%
Sealing tape material	Polyimide (PI)
Sealing tape width	0.5 cm (5 mm tabs) / 0.8 cm (8 mm tabs)
Sealing tape temperature rating	300°C
Pack contents	Al tabs + Ni tabs in matched pairs, plus 1 roll sealing tape

Related Products

- [CR2032 Coin Cell Kit](#) — coin cell format for preliminary electrode screening
- [Aluminum Laminated Film](#) — pouch cell packaging film, pre-cut to 200 × 100 mm
- [18650 Battery Case](#) — cylindrical cell hardware for full-cell prototyping

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