



Three-Electrode Solid-State Battery Test Mold

Operation Manual

Model: KLD-TB-500-MPA

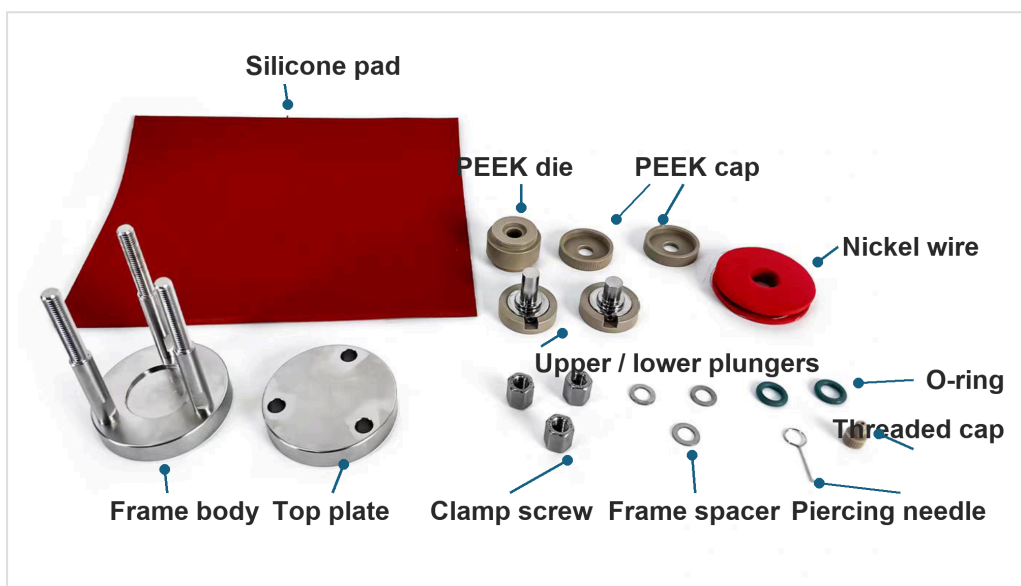
Version: V1.0

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1. Product Overview

LabCore KLD-TB-500-MPA is a compact three-electrode test mold designed specifically for all-solid-state battery mechanism research.

This product adds a **Reference Electrode (RE)** to the traditional two-electrode system, enabling researchers to **independently monitor the potential changes of the cathode and anode** during charge-discharge cycles. It is a critical tool for studying interfacial side reactions, impedance evolution, and failure mechanisms.



Product Photo

1.1 Key Features

- **Three-Electrode Configuration:** Working Electrode (WE), Counter Electrode (CE), and Reference Electrode (RE) independently connected
- **PEEK Core:** Excellent electrical insulation, chemical stability, heat resistance up to 200°C
- **High Pressure Capacity:** Maximum 5 tons, pressure up to 500 MPa
- **Compact Design:** $\phi 78 \text{ mm} \times H105 \text{ mm}$, suitable for glove box operation
- **Modular Structure:** Easy assembly, disassembly, cleaning, and electrode replacement

1.2 Applications

- All-solid-state battery mechanism research
- Lithium metal anode interface diagnostics
- Sulfide/oxide/polymer solid electrolyte evaluation
- In-situ EIS (Electrochemical Impedance Spectroscopy) testing
- Long-term cycling performance testing

2. Technical Specifications

Parameter	Specification
Model Number	KLD-TB-500-MPA
Core Material	PEEK (Polyetheretherketone)
Plunger Material	Tool Steel
Overall Dimensions	φ78 mm × H105 mm
Working Chamber Diameter	φ10 mm (customizable 5-20 mm)
Maximum Pressure	5 tons (50 kN)
Maximum Stress	500 MPa (standard)
Maximum Working Temperature	200°C
Electrode Configuration	Working / Counter / Reference Electrode
Maximum Screw Head Diameter	φ36 mm

Note: For higher pressure versions (1000 MPa), please specify in your inquiry.

3. Structure Description

KLD-TB-500-MPA adopts a **modular structure**, mainly composed of the following components:

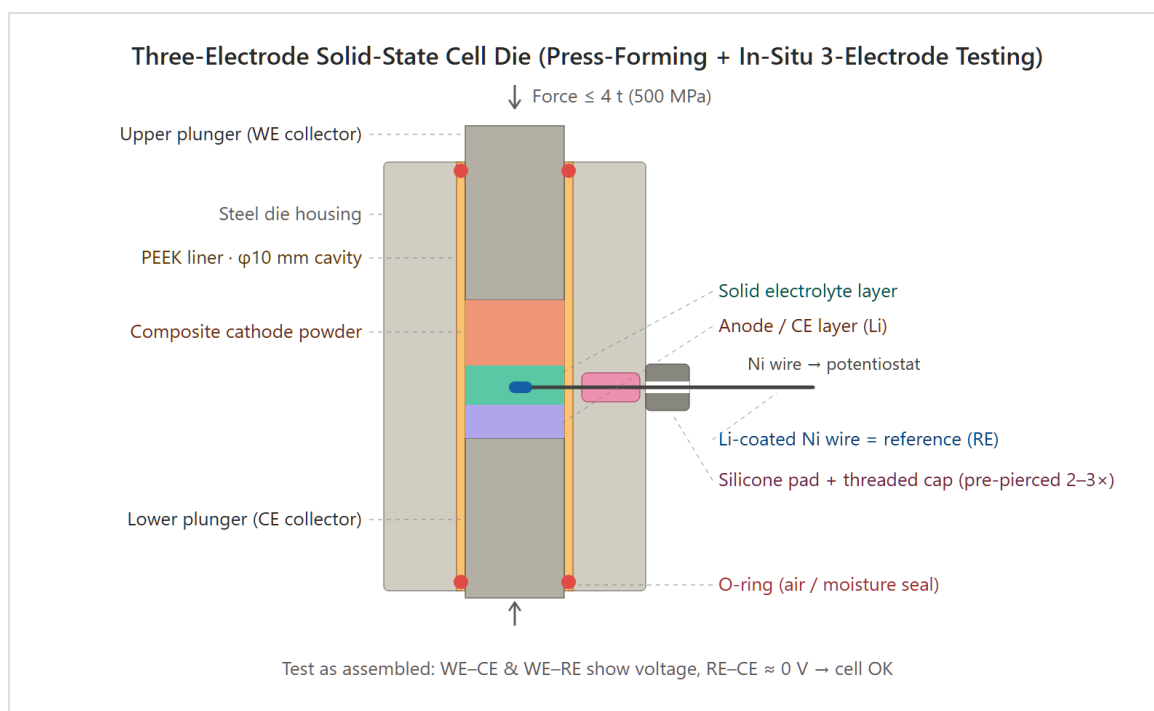


Figure 1: KLD-TB-500-MPA Three-Electrode Mold Structure Diagram

3.1 Main Components

1. **Upper Plunger** (Working Electrode terminal)
2. **Locking Cap** (Secures upper plunger, ensures sealing)
3. **PEEK Core** (Electrically insulated chamber, holds battery materials)
4. **Reference Electrode Lead** (Independently connected to electrochemical workstation RE port)
5. **Lower Plunger** (Counter Electrode terminal)
6. **Base** (Supports overall structure, ensures stability)

3.2 Electrode Wiring Instructions

- **Working Electrode (WE)**: Connect to upper plunger
- **Counter Electrode (CE)**: Connect to lower plunger
- **Reference Electrode (RE)**: Connect to PEEK core side lead

4. Operating Procedure

4.1 Preparation

Required Materials:

- Cathode foil (e.g., NCM811 coated on aluminum foil)
- Solid electrolyte powder (e.g., $\text{Li}_6\text{PS}_5\text{Cl}$)
- Anode material (e.g., lithium metal foil)

- Reference electrode material (e.g., Li/In alloy or lithium foil)
- Stainless steel spacers ($\varnothing 10$ mm)

Required Tools:

- Hydraulic press (5 tons or higher)
- Electrochemical workstation (supporting three-electrode testing)
- Glove box (argon or nitrogen atmosphere)
- Electronic balance (0.1 mg precision)

4.2 Assembly Process

⚠ All operations must be performed inside a glove box to prevent lithium metal and solid electrolyte from contacting air.

1. Clean Components

- Wipe all metal parts with lint-free cloth
- Clean PEEK core with ethanol and dry

2. Place Bottom Layer

- Place lower plunger into base
- Place stainless steel spacer (counter electrode current collector)
- Place anode foil (lithium metal foil, $\varnothing 10$ mm)

3. Add Solid Electrolyte

- Weigh approximately 80-100 mg of solid electrolyte powder
- Pour evenly into PEEK core
- Level the surface with a spatula

4. Insert Reference Electrode

- Cut Li/In alloy foil (or lithium foil) into thin strips
- Insert through PEEK core side hole, deep into the center of solid electrolyte layer
- Ensure good contact between reference electrode and solid electrolyte

5. Place Cathode Layer

- Place cathode foil (coated side down, contacting solid electrolyte)
- Place stainless steel spacer (working electrode current collector)

6. Seal the Mold

- Insert upper plunger
- Tighten locking cap (hand-tight, do not over-tighten)

7. Apply Pressure

- Place entire mold into hydraulic press

- Slowly increase pressure to 300-500 MPa (approximately 2.5-4 tons)
- Hold pressure for 5 minutes
- Slowly release pressure

4.3 Electrochemical Testing

1. Wiring

- Working Electrode (WE): Connect to upper plunger
- Counter Electrode (CE): Connect to lower plunger
- Reference Electrode (RE): Connect to PEEK core side lead

2. Aging

- Place mold in oven (60°C)
- Rest for 6-12 hours to allow interface contact

3. Start Testing

- Open Circuit Voltage (OCV) test: Confirm battery is working normally
- EIS test: Monitor interfacial impedance
- Charge-discharge cycling: Use three-electrode mode to independently monitor cathode and anode potentials

5. Precautions

5.1 Safety Warnings

- ⚠ **Lithium metal is highly reactive**, must operate inside glove box
- ⚠ **Sulfide solid electrolytes release toxic H₂S gas when exposed to water**, avoid moisture contact
- ⚠ **Apply pressure slowly**, avoid impact causing electrode short circuit or mold damage
- ⚠ **Maximum working temperature 200°C**, exceeding this will cause PEEK material deformation

5.2 Operating Recommendations

- **Solid electrolyte dosage**: Adjust according to working chamber diameter (φ10 mm approximately 80-100 mg)
- **Pressure control**: For first use, start from 200 MPa, gradually increase to 300-500 MPa
- **Reference electrode position**: Insert as close to the center of solid electrolyte layer as possible, avoid biasing toward either electrode
- **Electrode alignment**: Ensure upper and lower plungers are aligned, avoid eccentricity causing local over-pressure

5.3 Common Issues

- **Reference electrode potential drift:** Check if reference electrode has good contact with solid electrolyte
- **Abnormal impedance increase:** May be poor interfacial contact, recommend re-pressurizing or increasing aging time
- **Battery short circuit:** Check for metal particle contamination in solid electrolyte, or electrode rupture

6. Maintenance and Cleaning

6.1 Disassembly Process

1. Remove mold from hydraulic press
2. Loosen locking cap
3. Remove upper plunger
4. Pour out solid electrolyte and electrode materials from PEEK core
5. Separate lower plunger and base

6.2 Cleaning Method

- **Metal parts:** Wipe with lint-free cloth, clean with ethanol if necessary and dry
- **PEEK core:** Soak in ethanol for 10 minutes, ultrasonic clean for 5 minutes, vacuum dry
- **Reference electrode lead:** Gently wipe with cotton swab dipped in ethanol

6.3 Storage Recommendations

- Store all cleaned components in desiccator
- Avoid direct sunlight and high temperature environments
- For long-term storage, apply rust-prevention oil to metal parts

7. Customization Services

LabCore offers the following customization options:

- **Working Chamber Diameter:** 5 mm / 10 mm / 15 mm / 20 mm
- **Pressure Rating:** 500 MPa (standard) / 1000 MPa (custom)
- **Multi-Chamber Version:** Test multiple batteries simultaneously (2-4 chambers)

Contact Information:

-  Email: business@labcorematerials.com
-  Website: <https://labcorematerials.com>

Please specify in your email: model, specifications, quantity, and expected delivery time. We will reply with a quotation (USD, DDP to major US ports) within 48 hours.

8. Technical Support

LabCore provides professional technical support for all products:

-  Online Technical Articles: <https://labcorematerials.com/resources>
 -  Technical Support Email: business@labcorematerials.com
 -  Response Time: Reply within 24 hours on business days
-

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