Powder Resistivity& Compaction Density Measurement System

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Data Sheet

Parameter	
Resistance range	1μΩ~1200MΩ
Resistance accuracy	±0.05%
Resistivity range	10^{-6}Ω · cm~10^{9}Ω · cm
Conductivity range	10^{-9}^S/cm~10^{6} S/cm
Pressure range	0~ 550MPa
Pressure accuracy	±0.30% F.S
Thickness range	0~8mm
Thickness resolution / accuracy	0.5μm/±10μm
Max filling capacity	Φ16mm x 8mm
Temperature and humidity range	0~50℃、20~90%RH
Temperature and humidity accuracy	±2℃、±5%RH

Installation Requirement	
Voltage	220V
Voltage change tolerance	±10%
Power consumption	2100W
Environment temperature	25±5℃
Environmental humidity	Humidity at 40℃ <80%RH
Environmental magnetic field	Away from intense electromagnetic fields
Net weight	250Kg
Dimenstion (W*D*H)	370*580*1100(mm)

Model Table

Model	PRCD1000	PRCD2000	PRCD3000	PRCD1100	PRCD2100	PRCD3100
Stress & Pressure	Stress up to 1T & Pressure 70 MPa			Stress up to 5T & Pressure 350 MPa		
Test Principle	2-probe	4-probe	2-probe & 4-probe	2-probe	4-probe	2-probe & 4-probe
Applicable Samples	Cathode Samples	Anode Samples	Anode & Cathode Samples	Cathode Samples	Anode Samples	Anode & Cathode
Resistance Range	1 μΩ~20 MΩ			1μΩ~1200MΩ	1μΩ~200MΩ	
Sensor Resolution & Accuracy	Thickness Sensor: Resolution 0.5 μm, Accuracy±10 μm Stress Sensor: Resolution 0.1 KG, Accuracy±0.3% F.S. Resistance Sensor: Resolution 0.1 μΩ, Accuracy±0.1%F.S.					
Test Parameters	Thickness, Compaction Density Resistance, Resistivity, Conductivity Stress, Pressure Temperature & Humidity					
Other Specifications	1.Mold/Jig Diameter: 13 mm 2. L*W*H: 370*575*1140 (mm) 3. Instrument Power: 400W 4. Instrument Net Weight: 100KG			1.Mold/Jig Diameter: 13mm/16mm 2. L*W*H: 370*575*1140(mm) 3. Instrument Power: 2100W 4. Instrument Net Weight: 250KG		
Test Modes & Functions	Multi-pressure Test Mode: Suitable for testing of Compaction Density & Resistance without fixed steppings Variable Pressure Test Mode: Suitable for testing of Compaction Density & Resistance with fixed steppings Pressure Relief Test Mode: Suitable for testing of Rebounced Thickness Curve Steady-state Test Mode: Suitable for testing of Stress-Strain Curve & Elastic Modulus					

Note: IEST prioritizes continuous product updates, and our specifications are subject to change without prior notice.

B Instrument Principle

Test methods: Put a certain amount of powder (1~2g) into the mold and vibrate it, put the mold into the instrument box, set the pressure (≤200MPa) and the holding time, and start testing the thickness and resistance changes of the powder during the compression process.

Test parameters: Stress, pressure, thickness, resistance, resistivity, conductivity, & compaction density.

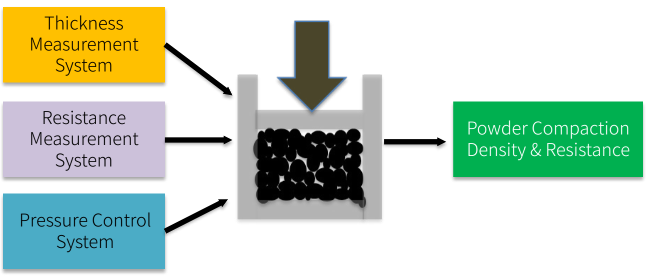
Calculation formula

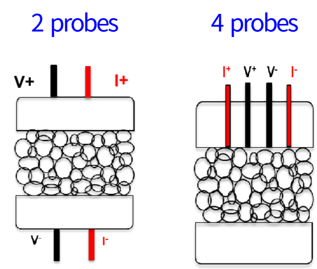
Compaction Density(g/cm^3): $D = \frac{m}{S*L}$

Resistance(Ohm): $R = \rho\frac{l}{S}$

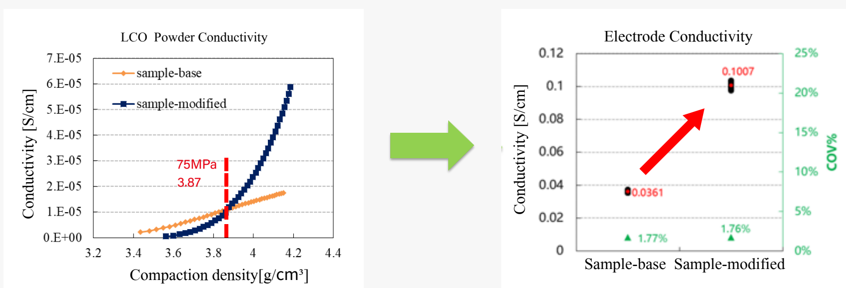
Conductivity (S/m): $\sigma_e = \frac{1}{\rho} = \frac{l}{RS}$

Resistivity(Ω*cm)-PRCD2100: $\rho = k\frac{U}{I}$ (Where k is the compensation coefficient)





C Why Compaction Density instead of Tapped Density?



LCO Powders

The compaction density of the LCO electrodes is around 3.8- 4.0g/cm^3 after calender.

Result analysis:

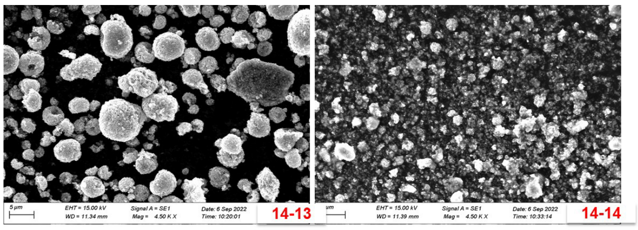
Result Analysis: Using LCO powder as an example, when the compaction density of the modified powder sample is less than 3.87g/cm^3 (pressure <75MPa), its conductivity is lower than that of the unmodified powder sample.

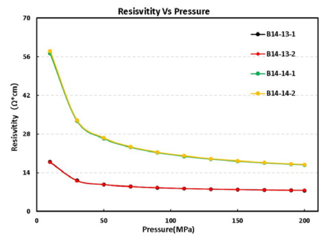
However, when the compaction density exceeds 3.87g/cm^3 (pressure >75MPa), the conductivity of the modified powder begins to surpass that of the unmodified powder, and the conductivity improves significantly as the compaction increases.

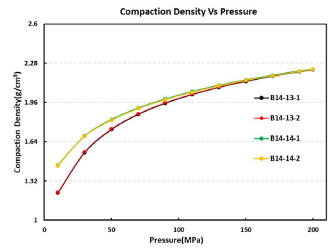
Conclusion: When testing the conductivity of powder, the compaction density should be close to the actual compaction of the powder in the electrode.

D Application Cases

(1) Cathode material-LMFP



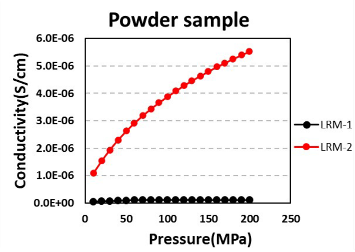




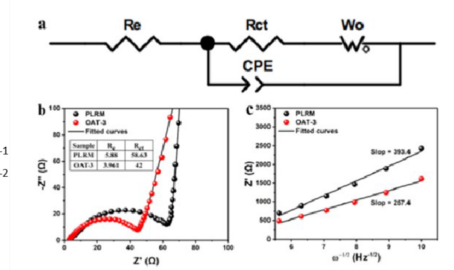
Conclusion 1: The conductivity of B14-13 is superior to that of B14-14. This is primarily due to its lower porosity, which enhances particle contact throughout the compression process, resulting in better conductivity.

Conclusion 2: The compaction density shows minimal difference under high-pressure conditions but varies under low-pressure conditions. This is mainly because samples with a wide particle size distribution have poor flow and rearrangement characteristics, leading to higher porosity and lower compaction density under low pressure.

(2) Lithium-rich materials



Model Coin Cell EIS testing



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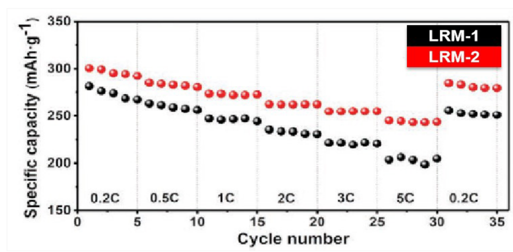
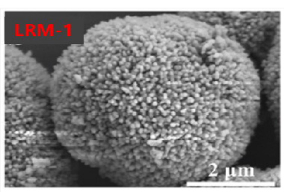
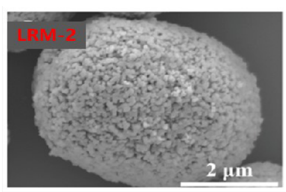
Model Coin Cell Cycle testing



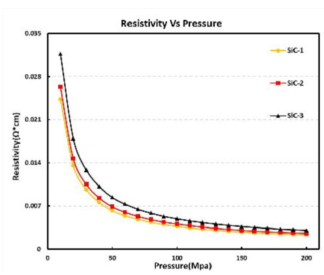


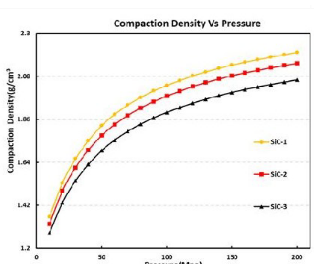


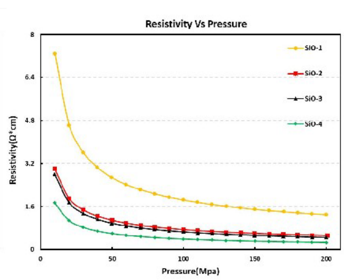
Analysis of the lithium-rich material with different modification methods.

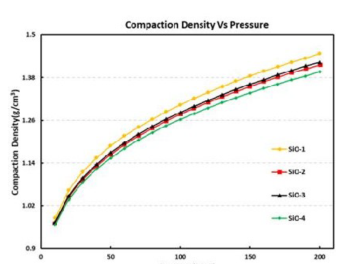
The resistivity of the lithium-rich material can be reduced effectively by adjusting its surface structure.

(3) Silicon-based materials









Test Condition: Si content: 3%, 6% and 10%(SiC-1/ SiC-2/ SiC-3)

Conclusion

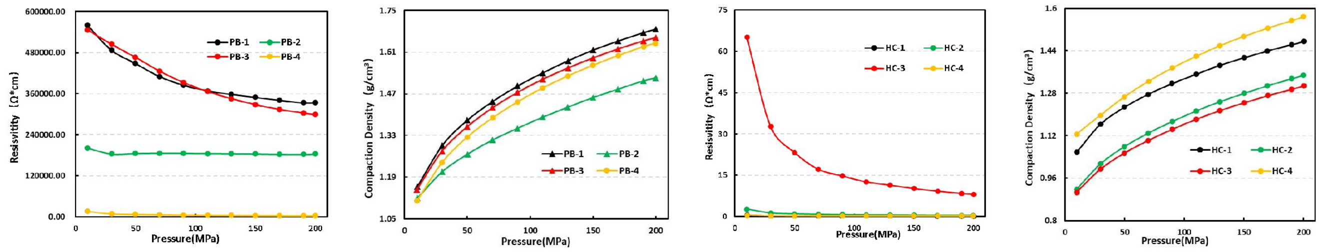
Resistivity: SiC-1< SiC-2< SiC-3
Compaction density: SiC-1> SiC-2> SiC-3

Test Condition: Sintering temperature of SiO Materials: SiO-1< SiO-2<SiO-3<SiO-4

Conclusion

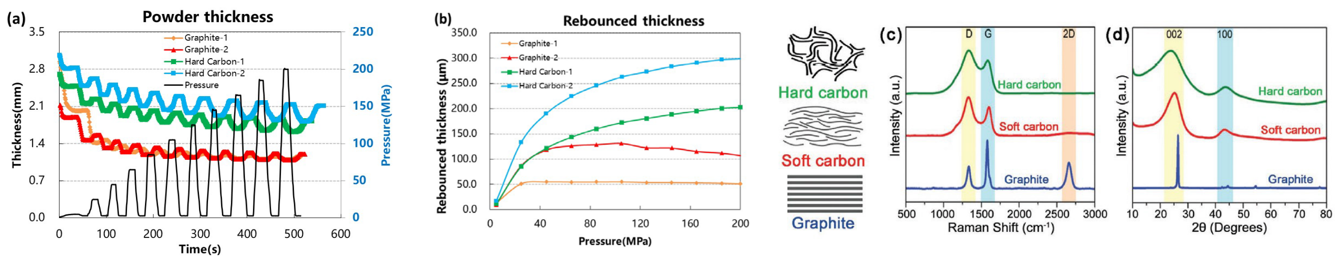
Resistivity: SiC-1> SiO-2> SiO-3> SiO-4
Compaction density: SiC-1> SiO-2> SiO-3> SiO-4

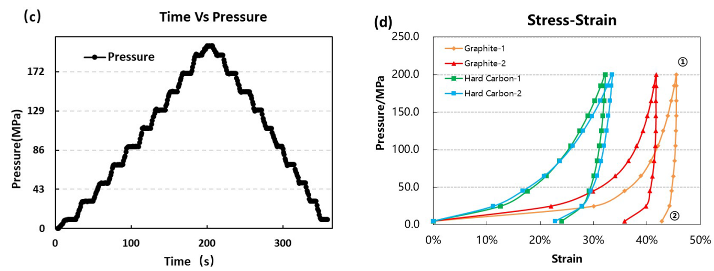
(4) Anode & cathode materials for sodium ion battery



Conductivity evaluation of anode & cathode powders for sodium ion batteries : Effectively evaluate the conductivity and compaction properties of Prussian blue and hard carbon under different modification conditions.

(5) Compression properties of carbon materials





Name	Reversible Deformation	Irreversible Deformation	Max Deformation
Graphite-1	2%	43%	45%
Graphite-2	6%	36%	42%
Hard Carbon-1	8%	24%	32%
Hard Carbon-2	10%	23%	33%

Conclusion: the conductivity of graphite is greater than that of hard carbon, so is its powder compressibility.

E Testing Mold

Mold for testing

Automatic demolding instrument

Mold Parameters	
Mold material	Stainless steel, Ceramic, PEEK
Diameter	10mm/13mm/16mm
Test pressure	Up to 550MPa
Service life	12000 times

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