

Battery Consistency Screening

——BCS6000



1 Background and significance of battery cell consistency testing before shipment

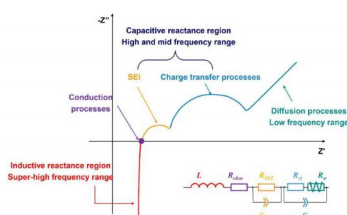
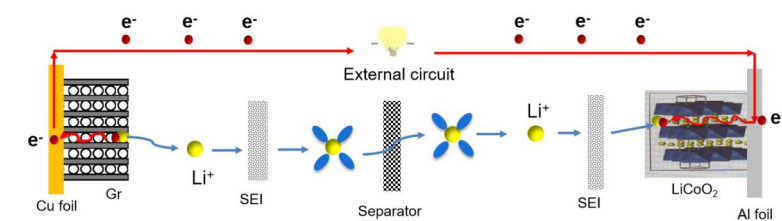
In new energy vehicles or energy storage power stations, lithium batteries are often used in the form of multiple parallel modules or packs. Therefore, high consistency requirements are placed on the battery cells in the same module or pack. Otherwise, thermal runaway may occur easily due to overcharging/overdischarging of a certain battery cell, leading to many after-sales problems.

Electrochemical impedance spectroscopy (EIS) has good sensitivity and correlation with the **SOC, SOH, internal temperature, internal short circuit**, etc. of the battery cell. By using fast EIS testing and neural network algorithm modeling, you can effectively screen the consistency of the battery cells and help the cascade utilization of the battery cells.

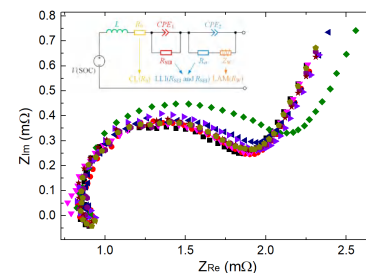


2 Creative Solution

Electrochemical impedance spectroscopy (EIS) can be used to characterize the resistance of electrochemical processes with different time constants. Introducing EIS testing before battery shipment or after battery delivery, and comparing the impedance differences between different batteries, can **(1) screen the consistency of batteries; (2) find abnormal batteries; (3) help analyze the failure mechanism of batteries!**



Item	Description	Time	R
Electronic transportation	① Between active materials	Extremely fast	R_s
	② On the collecting fluid		
	③ On the external circuit		
Ion transport	① Solvation and Desolvation	fast	\
	② Passing through SEI membrane	fast	R_{SEI}
	③ Diffusion in electrolyte	Related to concentration	R_{cp}
Electron & ion binding	① Electrochemical reaction	slow	R_{ct}
	② Diffusion in solids	Extremely slow	R_{cp}



3 BCS6000 Introduction

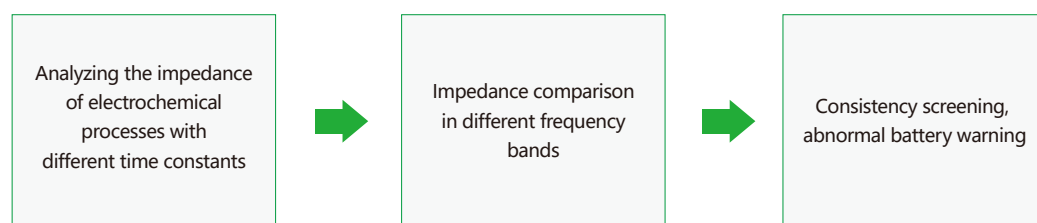
Functions & Features:

- ① Wide range of applicable cells, ranging from **1Ah to 500Ah**;
- ② Fast EIS frequency sweep testing, with a frequency range of **1500Hz ~ 0.1Hz**;
- ③ Equipped with OCV testing, DCR testing, constant current charge-discharge testing, etc.;
- ④ Battery Consistency Screening;
- ⑤ Dynamic fitting screening algorithm for batch screening.



Appearance

Screening Principles:



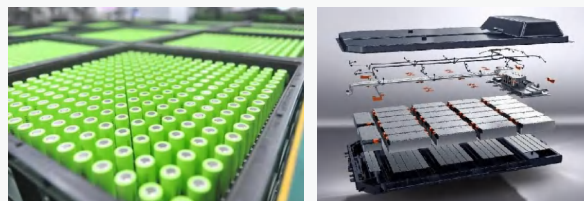
4 Application Scene

Scene 1: Battery shipment, OCV stage consistency assessment



Full Detection on the OCV or ACIR Testing Segments

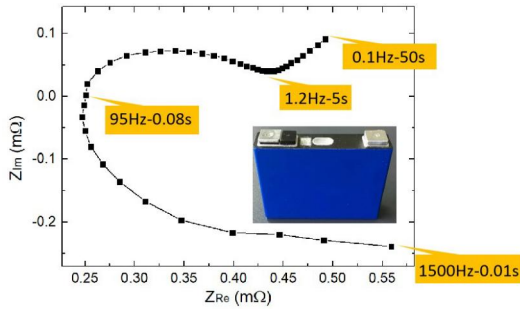
Scene 2: Consistency testing of incoming battery materials



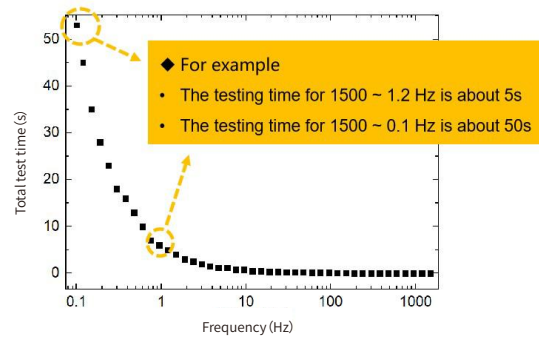
Battery Incoming Quality Control Before Grouping / Packing

5 Case 1

EIS test of LFP battery with Capacity of 280Ah (1500 Hz~0.1 Hz)

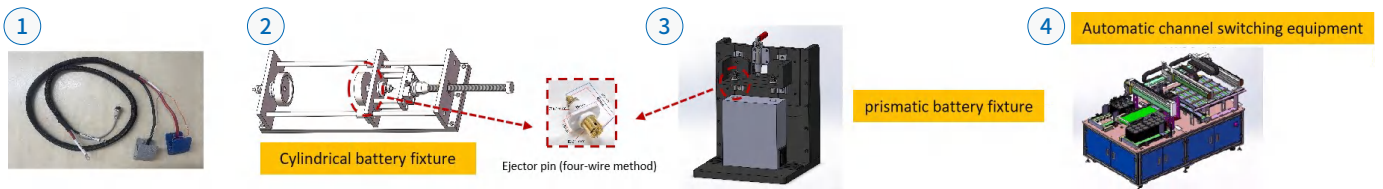


Frequency vs. Total Test Time



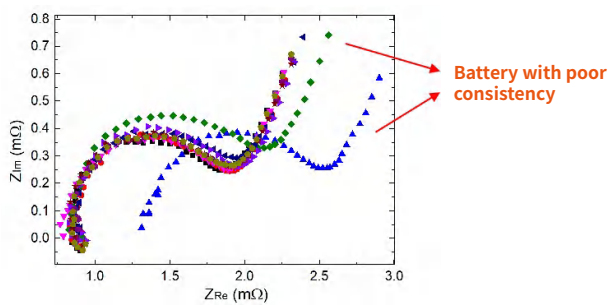
The EIS frequency range can be adjusted according to the production line pace and process segment

EIS test of LFP battery with Capacity of 280Ah (1500 Hz~0.1 Hz)



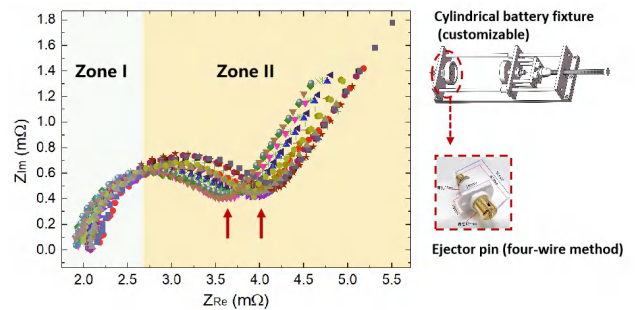
6 Case 2

1. EIS screening is conducted on 30 prismatic cells with a capacity of 50Ah each (at 50% state of charge) over a frequency range from 1500Hz to 0.1Hz.



Especially for the battery represented by the green line, its impedance in the high-frequency region is consistent with other batteries, and only the impedance in the medium and low-frequency regions has a large difference. In this case, if only the electronic resistance or 1000Hz impedance is tested, it cannot be effectively distinguished, but swept frequency EIS can effectively screen and identify!

2. EIS screening is conducted on 40 cylindrical cells with a capacity of 30Ah each (at 6.5% state of charge) over a frequency range from 1500Hz to 0.1Hz.



In zone I: For ohmic impedance and SEI impedance, the 30 batteries are distributed relatively concentratedly, with no obvious differences; In zone II: Rct is divided into two concentrated areas, indicating that there are certain differences in the ionic impedance of the 40 batteries, which will affect the capacity after long cycles.

7 Parameters

	BCS6000
Number of Channel	1
Independence	Use independently
Current limit	0.2~30A
Application scenario	Monitor battery consistency during OCV testing process
Voltage accuracy	0.01%
EIS test range	1500Hz ~ 0.1 Hz
Impedance test accuracy	<0.01mΩ
Applicable battery capacity	EIS test for battery with capacity of 1~500Ah
OCV Test	√

Note: IEST is committed to continuous product improvement. Any changes to technical specifications will be made without prior notice.



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