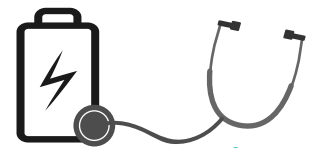


# CHEN TECH Application Note

# State of Health (SOH) Evaluation for Lithium Batteries



**SOC** (State of Capacity) has been gradually replaced by **SOH** (State of Health) and become the mainstream of the focus on battery's life cycle and health evaluation. Although there is still no such a standard for measurement, many studies have confirmed that **SOH** is able to provide a more comprehensive and accurate estimation of a battery's health status.

## Theory

Recently, the most popular method of **SOH** evaluation is to compare the current status of a used battery with that of a new battery. During the process, several different parameters will be considered and then a "relative" health status will be calculated. The evaluation for a battery cell focuses on the differences between charge/ discharge performances, while the battery pack focuses on the consistency among each single cell.

- Comparative index between new and used battery cells: capacity, internal resistance, voltage concentration ratio, self-discharge rate, energy conversion efficiency, etc.
- Comparative index between new and used battery packs: capacity, energy conversion efficiency, consistency (internal resistance, voltage difference, temperature difference), etc.

## Evaluation Method

### Complete Test (Available in Chen Tech Equipment)

Based on the testing standard IEEE 1188-2005, record the voltage, current, and temperature values from a full charge and discharge cycle, find the rates for different indexes, and calculate the **SOH** with pre-defined weights.

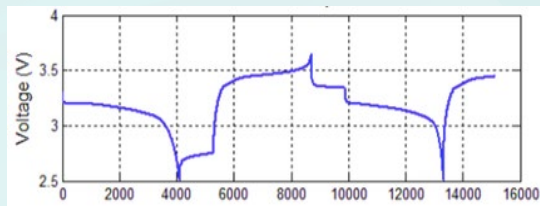


Diagram 1 Example of IEEE 1188-2005 Test

### Rapid Test (Available in Chen Tech Equipment)

Measure the parameters while charging and discharging in certain status, or performing a specific charging/ discharging pattern. Some automobile manufacturers collect **BMS** data regularly, and use the data to calculate **SOH**.

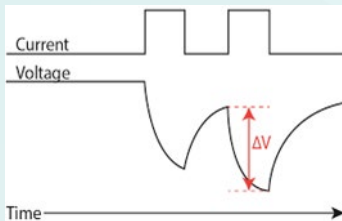


Diagram 2  
Example of IEEE PESC 2006, a two-pulse method proposed by Dr. Marin Coleman

### Precision Test

Besides the variation of voltage, current, and temperature during charge/ discharge process, extra information such as Entropy, Enthalpy, X-ray is also collected and used to calculate the **SOH**. This method provides the most precise results as it comes from assessing chemical reaction of raw materials.

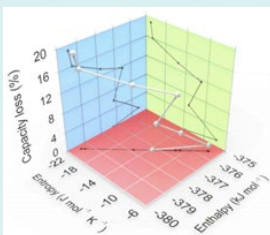


Diagram 3  
A thermodynamics method from Dr. Richid Yazami, a professor of Nanyang Technological University, Singapore

### Comparison of Various Evaluation Methods

	Complete Test	Rapid Test	Precision Test
<b>Accuracy</b>	High	Average	Extreme high
<b>Time Required</b>	Long	Short	Short
<b>Requirements of Equipment Specs</b>	Moderate	High (Pulse and mS data recording capability needed)	Extreme high (Instruments for electrochemistry study needed)



▲ ABT 1000 Series



▲ MCL2 Mini Series

The following Chen Tech battery test equipment supports **SOH** Evaluation with a modeling tool kit, and data analysis software: **BT 1000 Series**, **PBT 1000 Series**, **MCL2 Series**, **MCL2 Mini Series**, **ABT 1000 Series**, and **MCL Plus Series**.

**Chen Tech** has been a leading supplier in the battery test industry, in Taiwan for more than 30 years. Our high-quality products are provided to global customers at a competitive price, and our clients include famous battery manufacturers in Japan and research institutes in the U.S. We can also customize different specifications and programs for our customers depending on their requirement. For further information and questions please don't hesitate to contact us.

[www.chentech.com.tw](http://www.chentech.com.tw)

■ HEADQUARTER | TAIPEI, TAIWAN  
1F, NO.27, LN.61, SEC.1, GUANGFU RD., SANCHONG DIST.,  
NEW TAIPEI CITY 24158, TAIWAN ☎ +886-2-22783825  
☎ +886-2-22783926 ✉ sales@chentech.com.tw

■ SUZHOU, CHINA ☎ +86-512-62531842 ■ OHIO, USA ☎ +1-440-248-8001  
■ TOKYO, JAPAN ☎ +81-90-36938453 ■ CALIFORNIA, USA ☎ +1-408-565-9050  
■ SEOUL SOUTH KOREA ☎ +82-2-34537185 ■ BANGKOK, THAILAND ☎ +66-2-261-4050/51  
■ DAHKA, BANGLADESH ☎ +880-1713410811

