Roundtable 2: Battery Test Procedures

Outcome

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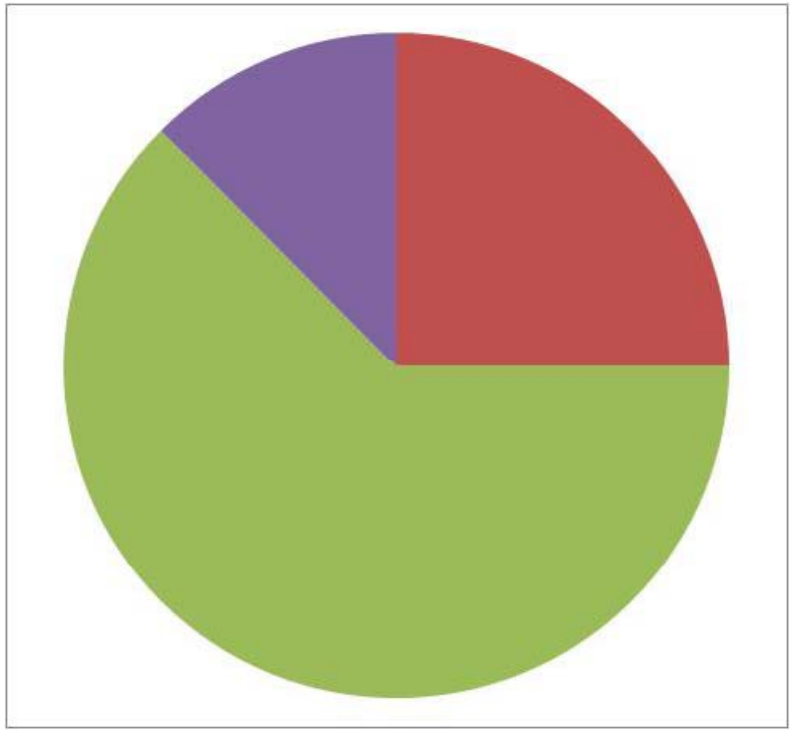
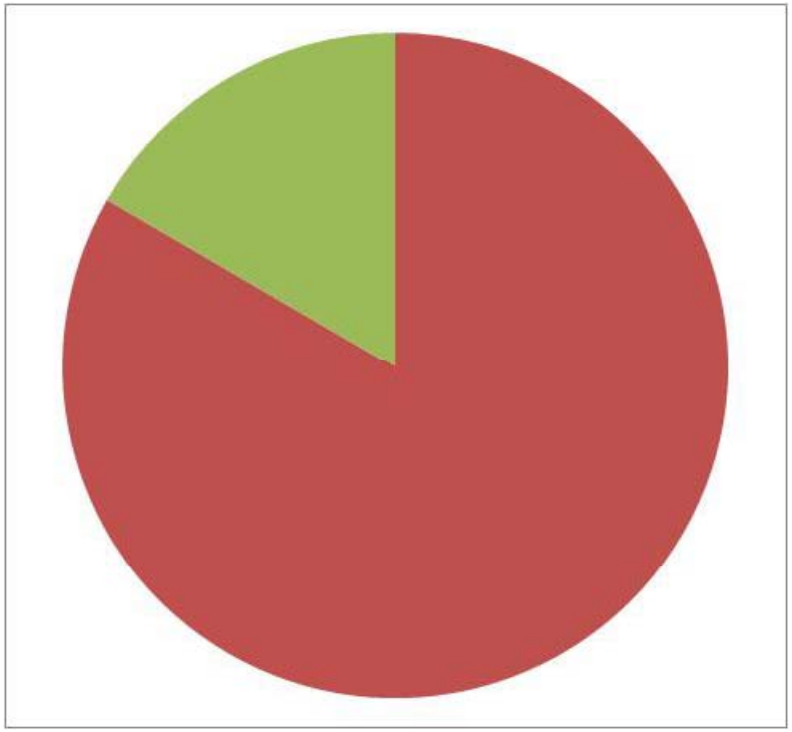
Roundtable 2 Vehicle Survey Results

China, as forecast by the Chinese



US, as forecast by the Americans



Outcome -- Overview

- This roundtable represents the first step in the international collaboration in the hope of agreeing on a set of international testing protocols. Currently, each group uses somewhat different test protocols to characterize performance and predict life and to demonstrate abuse tolerance for batteries in HEV，PHEV and EV applications. Each approach has intrinsic assumptions. Based on these assumptions, the resulting test procedures from one approach may stress the battery more than those from the others. Clearly, a careful comparison of these procedures is needed to determine the similarities and differences between them. Some experimental work may be needed to determine the magnitude of the differences which may be present in the test results.
- 这个圆桌会议是国际合作的第一步希望规范国际测试方法。 现在， 不同的研究小组采用各自不同的测试方法来表征和预测HEV，PHEV和EV电池的性能， 如寿命和滥用性等。每个测试方法基于各自特有的假设。这将导致不同的测试方法对电池有相当不同的影响。很显然， 不同方法之间小心的比较是必须的来决定不同方法间的异同。这需要一些实验工作来决定多大程度上实验方法对实验结果的影响。

Bottom line result

- We did not identify testing protocols and methodologies that both the U.S. and China are willing to agree on today.
- We DID identify serious and various differences between our two testing programs.
- We also identified a path forward to better understand the details of the differences, and how we might bridge the gaps.

Results

- Differences between the U.S. and Chinese approach to battery testing for HEV, PHEV, and BEV have been identified and discussed. Differences span from…
  - implicit assumptions
  - testing protocols
  - objectives of the tests
  - philosophy of testing
  - even the measurements themselves

  Example: There were differences in objectives. The objective in the US is to demonstrate the potential for the application. The objective in China is to demonstrate actual performance and life in a given application.

- It was also identified that new methods may need to be developed.

  Example: Fast cycle test, in development in China. Extremely accelerated testing – very high temperature and very short cycles.

Examples from Testing (1)

Cell Characterization

China:

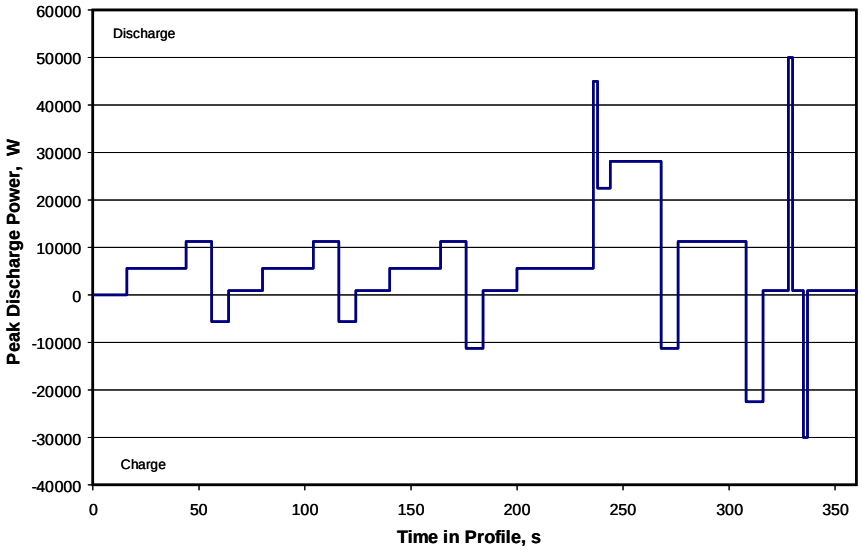
单体cell----20℃放电容量(20℃ Discharge Test)、功率测试(Power Test)、-50℃~100℃放电容量(-50℃~100℃ Discharge Test)、充放电特性测试(Charge / Discharge Characteristics Test)、常温/高温荷电保持能力(Self-discharge Test)、大电流放电试验(High Current Discharge Test)、常规循环寿命试验(Cycle life Test)、模拟工况循环寿命试验(Condition Cycle life Test)、安全试验Safety Testing -- (包括针刺Acupuncture 、挤压Extrusion 、短路Short 、过充Overcharge 、跌落Drop 、高温high temperature) 等

US:

Batteries are characterized in terms of constant-current capacity, self-discharge, hybrid pulse-power capability (HPPC), cold cranking (5 kW at -30°C), thermal performance and energy efficiency at 30°C

Example From Testing (2)

- Life Test in China
  - 循环寿命Cycle life
  - 55°C搁置寿命High-temperature battery life on hold
  - 55°C加速循环寿命（ High-temperature Fast cycle life (still in research stage)）
- Life Test in US (PHEV)
  - Charge-depleting cycling at 30°C
  - Charge-sustaining at 30°C
  - Periodic reference tests to quantify change



Example from Testing (3) – Safety and Abuse

- China
  - 过充电保护-Overcharge protection
  - 过放电保护-Over-discharge protection
  - 短路保护-Short-Circuit Protection
- US
  - Overcharge/over discharge
  - Short circuit
  - Crush
  - Nail Penetration

Proposed Next Steps

- Objective:
  - To understand and bridge the differences between U.S. and China with respect to the current battery testing methodology and procedures, and then to identify and develop new methods and measurement techniques for vehicular batteries
- Method: Perform a collaborative experiment in which both the U.S. and Chinese counterparts test identical batteries and/or cells, and publish the results collaboratively.
- There are 3 parts to the experiment. The coordinators for this experiment are Chamberlain (ANL) and Qiu (Tsinghua University)
  1. Performance and life testing
  2. Abuse and safety testing
  3. Mechanisms and Models

Expected Results from Collaboration

- Have a basis of discussion of methodology, philosophy, and, ultimately, procedures. Specifically:
  - Jointly publish experimental results, so that differences can be quantified and, in a way, the two groups can be calibrated in their approach
  - Probe and/or determine whether the U.S. and China can harmonize their methods and procedures
  - Possibly develop new methods and measurement techniques
  - Possibly extend these results, forming a joint national committee strategy to present to the IEC and ISO
  - Publicize the results