Mitsubishi Motors Development Engineers Reveal Their PHEV Problems

How has Mitsubishi improved the reliability of its batteries and software?

Naoshige Shimizu
Nikkei Automotive Technology

Abstract:
Released at the end of January in 2013, Mitsubishi Motors' plug-in hybrid electric vehicle (PHEV) "Outlander PHEV" has been plagued with defective batteries. Coupled with the overheating and combustion of the Li-ion secondary battery, numerous issues concerning the control software were detected in the vehicle, and recalls were reported. With the rapid advancement of the electrification and computerization of automobiles, the issues at Mitsubishi captured the attention of the entire automotive industry.

Part 1 will examine the causes of the issues affecting the Mitsubishi's Outlander PHEV's battery, and will clearly explain solutions. The leader of Mitsubishi development team Mr. Kazumasa Iida will describe the roots of the problem. The control software, on the other hand, is an issue reported not only by Mitsubishi, but throughout the industry.

Part 2 will analyze the trends in recently reported software defects, as well as outline of new developments under way at other key firms are also covered, including Mazda and Calsonic Kansei.

Part 1: Causes of the Mitsubishi Outlander PHEV's Battery Combustion Accidents, and Their Solutions

—The necessity of adopting viewpoints of different technological fields into EV development

Supplementary Information 1
A New Screening Process: Product of Thinking Outside the Box
Supplementary Information 2
Kazumasa Iida, Assistant Head Officer of the Development Group Headquarters at Mitsubishi Motors
Transforming Organizational Culture to Improve Product Quality

Part 2: Software Issues and Solutions

—Increasing issues related to charger/battery control and automatic brakes, and the need for simplification

Supplement: FTA Diagram Related to Li-ion Secondary Battery Manufacturing Process

Nikkei Automotive Technology published by Nikkei Business Publications (Nikkei BP) is Japan's first comprehensive magazine that devotes editorial content not only to automotive technology updates but also to related engineering areas such as environmental protection, precision and appliances. Its target readers are engineers engaged in research, development and manufacturing of automobiles, automotive parts/materials and facilities. Key advertising clients include manufacturers of electronic and other automobile parts, makers of industrial precision robots for factory use, and developers of measuring components/software. "Nikkei BP Japan Technology Report" is a fee-based publication offering English-language translations of key technical articles selected from the full array of Japanese-language Nikkei BP publications. (http://techon.nikkeibp.co.jp/english/)

Mitsubishi Motors Development Engineers Reveal Their PHEV Problems

Part 1: Causes of the Mitsubishi Outlander PHEV's Battery Combustion Accidents, and Their Solutions

The necessity of adopting viewpoints of
different technological fields into EV development

Abstract:
The Mitsubishi Outlander PHEV's Li-Ion secondary batteries have experienced overheating and combustion. After analyzing various factors, two causes have emerged: damage caused by the unintended dropping of the batteries while on the production line, and the misconfiguration of measuring instruments. These issues were properly corrected, resolving the battery problems, though numerous failures within the software have also been reported. An overarching theme behind these issues is that despite in the rapidly advancing electrification and computerization of automobiles, auto manufacturers approached EV development with a conventional development mindset. There was insufficient communication between engineers in different technological fields.

Mitsubishi Motors released the “Outlander PHEV” plug-in hybrid electric vehicle at the end of January in 2013 (**Fig. 1**). The electrodes of the vehicle’s Li-ion secondary battery cell short-circuited, causing the battery pack to erode and combust. (**Fig. 2**). Independent of this battery problem, numerous defects also surfaced with regard to the vehicle’s control software; so far, Mitsubishi has reported two recalls to the Japan Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and has initiated three service campaigns. The company held two press conferences in April 2013 to explain the background and causes of the incidents after they found the battery defects. In July, the company invited the public to observe the operations replacing the recalled batteries.

In March of 2013, Mitsubishi Motors reported four defects related to the Li-ion secondary battery (**Table 1**). One defect occurred in the electric vehicle (EV) “i-MiEV,” with the remaining three occurring in the Outlander PHEV. All four cases had been found before the vehicles were sent to customers.

Fig. 1 The Outlander PHEV’s appearance

Equipped with 12kWh Li-ion secondary battery. The number of battery cells totals 80.

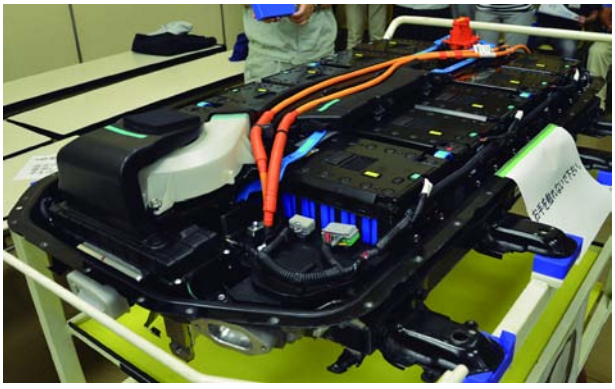

Fig. 2 An overheated and combusted Li-ion secondary battery after shipment

The battery pack to be installed on the Outlander PHEV