



The concept of develop technologies for assessing EV safety and comprehensive safety management

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Develop technologies for assessing EV safety and comprehensive safety management

■ Introduction

- A Comprehensive Study on the Strengthening of Manufacturing Standards and Development of Inspection and the Conversion of Maintenance Personnel for EV
- Period : `23.4 ~ `26.12(4years, USD \$22 millions)
- Participants : KATRI(Principal), KATECH, Hyundai Motors and several companies



■ What to do

- 1. Development of safety standards and certification systems for the manufacture of EV**
2. Development of EV Inspection Technology and Equipment
3. Development of an Education System for the Transition of ICE Maintenance Personnel to EV

Development of safety standards and certification systems for the manufacture of EV

- What to do

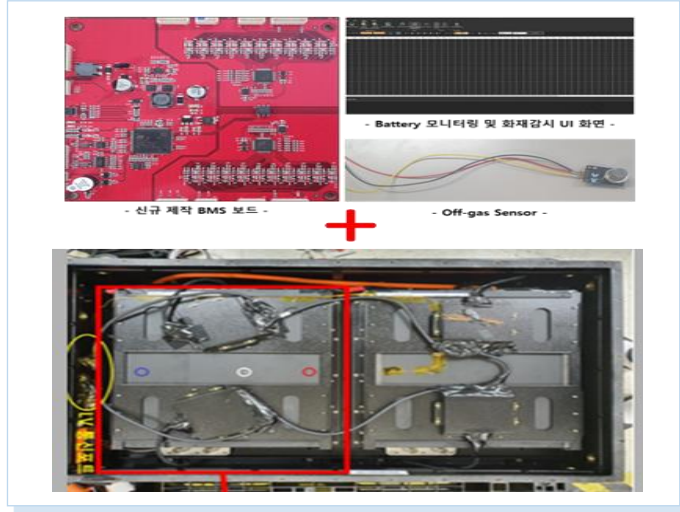
- Development of safety evaluation technology and monitoring technology of accidents such as EV fire, explosion, short circuit, etc
- Researching and Development of BMS Safety Standards and Fire Prevention Technology
- Development of New REESS Safety Certification System(Self certification -> Type approval)
- Development of REESS Registration System(History Management) and Battery Durability Standards

Development of safety standards and certification systems for the manufacture of EV

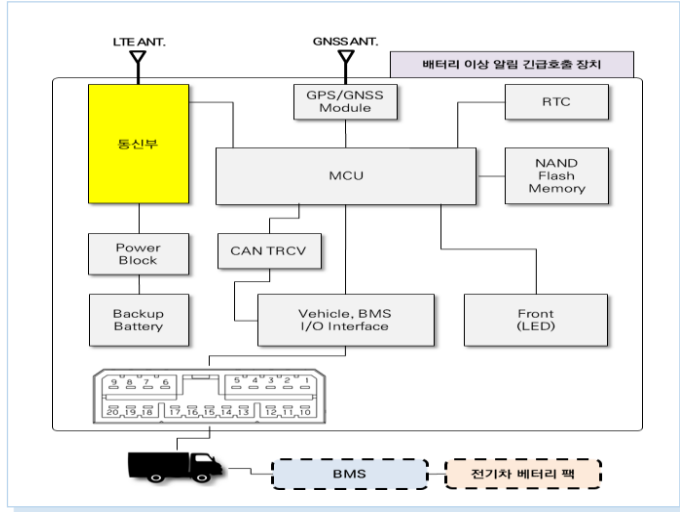
- Development of **BMS Safety Standards** for EV
 - A Study on the presentation direction of BMS Safety Functional Standards Guide
 - Operating condition of the warning signal including Usual parking mode
 - Progressive increase in monitoring time during parking or application of TR detection technology
 - ex) monitoring time : 1hr -> 2hr -> 4hr -> 12hr -> maximum 24hr (90% of events occurring within 24 hours after fully charged)
 - Presentation of BMS-based REESS **abnormality warning criteria**(self warning : Prohibition and evacuation orders for vehicles using the vehicle's AV system and a 911 call)
- **TR detection** system
 - A Study on TR detection technology using Photo sensor, Pressure sensor, CO sensor
 - Established of REESS system with BMS and sensors
- Development of **emergency call device HW/SW for REESS abnormality notification**(for do not provide connected service)
 - Derive and reflect emergency call unit key functions and requirements
 - Evaluation of emergency call device performance based on production and simulation of actual vehicle installation
 - Integrated demonstration of emergency call technology based on actual vehicle installation

➤ Instrument cluster **warning lamp illuminated** after TR **detection**, prohibit access alarm, **fire department automatically requested to be dispatched to quickly extinguish and prevent spread**

[BMS, gas sensor-linked battery pack]



[Emergency call unit circuit]

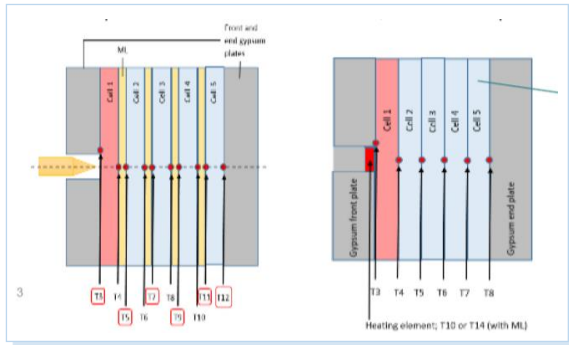




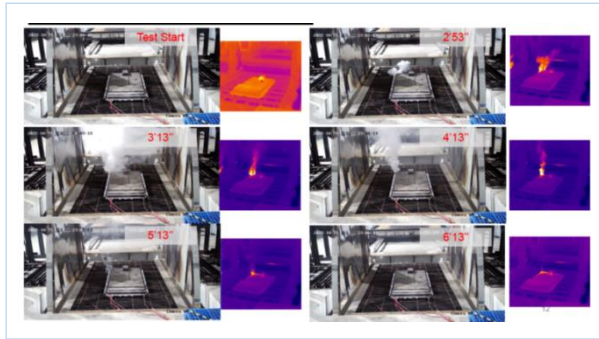
Development of safety standards and certification systems for the manufacture of EV

- TP test evaluation technology
 - Active cooling / harsh simulation battery system **TP analysis**
 - Analysis of the hazards of gas to humans in the event of a battery fire
 - **Establishment of TR and TP test evaluation measures** at the level of cell type, battery and vehicle(**Usual parking**)
 - Analysis of TP delay battery system's TR and TP test
- TP delay battery system
 - Analysis of TP characteristics and causes by cell type
 - Analysis of battery system and material for TP delay
 - **material selection and module and pack structure design considering TP delay characteristics**

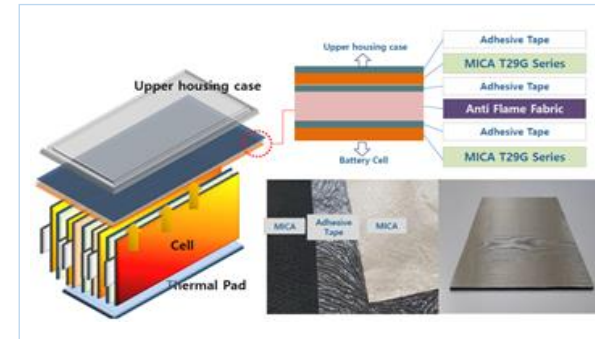
[Test method by Cell]



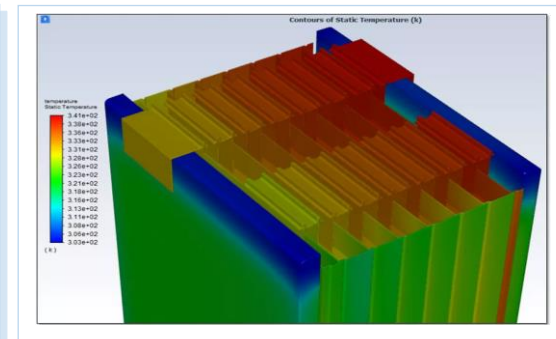
[TR and TP aspects of battery systems]



[Application of delay material]



[TP characterization]



➤ **Enhance battery fire safety** by developing **TR and TP test evaluation technology** and **TP delay system** by cell type and external environment

Development of safety standards and certification systems for the manufacture of EV

[vehicle-based crash scenario]

- Development of **EV crash safety evaluation technology**
 - Derivation of evaluation test **based on fire and explosion scenarios in the real accident**
 - Analysis of REESS crash severity through the current representative crash evaluation method
 - **Derivation of REESS crash evaluation technology**
 - **Review of institutionalizing EV crash safety evaluation**
- Development of insulation resistance and protection grade evaluation technology for high-power electrical devices
 - Derivation of insulation resistance and protection grade evaluation items and analysis of actual vehicle data
 - **Review of the implementation rules** of insulation resistance and protection rating
- Development of vehicle-level battery durability safety standards and evaluation criteria
 - Establishment of performance standards according to the mileage of EVs according to **UN EVE GTR22**
- Development of safety and evaluation standard for high and low temperature performance of vehicle-level batteries

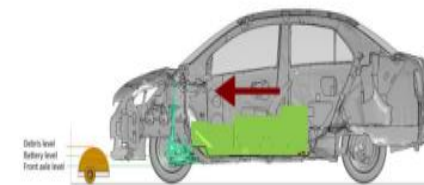


High Speed Collision with Road Facilities

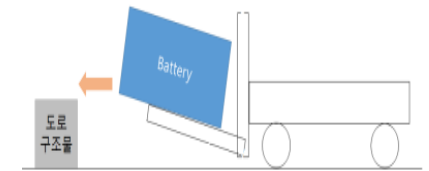


Crash with lower part of facilities

[Verification of the correlation between the vehicle and REESS]



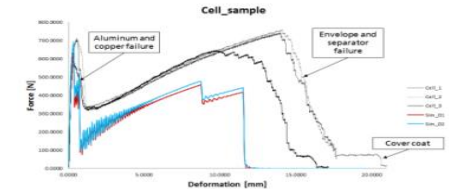
Real vehicle crash evaluation



crash evaluation by component level



damage verification by component level



crash severity evaluation by component level



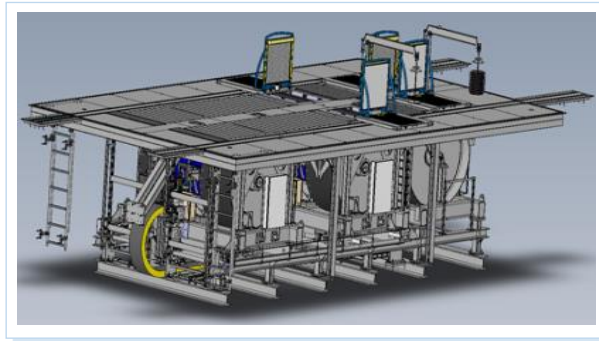
Development of safety standards and certification systems for the manufacture of EV

- Development of vehicle-based battery **durability evaluation test equipment**
 - Analysis of battery durability verification policies and GTR15, 22 requirements
 - Derivation of specifications for durability evaluation equipment that simulates external environment and driving environment
 - Development of **a driving environment simulation system for evaluating the battery durability** of the vehicle-based
 - Development of **an external environment simulation system for evaluating the battery durability** of the vehicle-based battery
- Development of **REESS safety evaluation equipment**
 - Research on technology trends in establishing an evaluation environment according to international standards (GTR20, UN R100) and KMVSS, etc
 - prototype production of **REESS safety evaluation test equipment**
 - Improve performance and reliability of evaluation systems through operational data analysis

[durability evaluation test equipment]



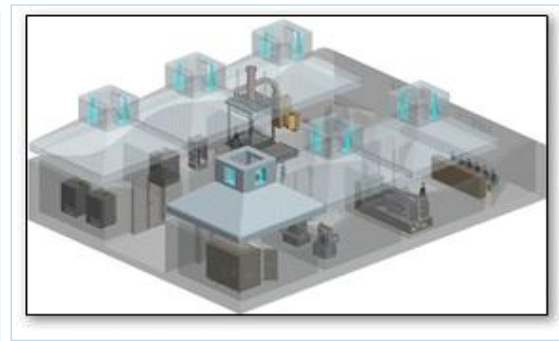
[durability evaluation test equipment]



[Standard of REESS safety]



[REESS safety evaluation equipment]



➤ Newly revised battery performance and safety standards, such as **durability standards and TP test standards, can be evaluated**



Development of safety standards and certification systems for the manufacture of EV

- Development of a safety certification system for core parts such as EV batteries
 - **Proposed amendment to the Vehicle Management Act** to prepare the basis for the safety certification system
 - **Pre-certification of suitability with safety standards** for core devices such as REESS
 - Define the core device and prepare the manufacturer management plan
 - **Establishment of safety certification system procedures and methods** for core devices
 - ☞ Safety certification system: Classified into safety performance test and conformity test
 - ☞ Test Laboratory Designation and Confirmation Procedure: Regulation of the designation procedure such as test facility specifications and organization
 - ☞ Safety performance test: Implementation of performance test agent, implementation of designated test laboratory, implementation of in-house test facility
 - ☞ Regulations on the issuance of safety certificates and the method of marking safety confirmations
 - ☞ Suitability test: Conducted 3 years after the date of safety certification
- A Study on the **Institutionalization of REESS History Management** for EV
 - **Proposed amendment to the Vehicle Management Act** to prepare the basis for the safety certification system
 - Enter the identification number of REESS at vehicle registration
 - **Investigation of REESS identification number** indication status
 - ☞ Investigation of **domestic and international REESS history management cases** and similar cases
 - ☞ Investigation of International Standards
 - Collection of inspection and maintenance history information during vehicle operation
 - Collection of performance test information for abandoned vehicles



Development of safety standards and certification systems for the manufacture of EV

- Development of **detailed rules for TP test**
 - Development of TP test Criteria with considered rationale for extending from 5 minutes to the average fire department dispatch time
 - A Study on the Selection of Target Cells and the Measurement Method of venting Gas
- A Study on the **Institutionalization of Fire Prevention and Safety Management** for Removable REESS
 - Investigation of Removable REESS Fire Case and Establishment of Institutionalization Plan

[Removable REESS fire cases]

