전기차 안전

전기차용 충전 케이블의 유체 순환 냉각 시스템 분석

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Analysis of the Fluid Circulation Cooling Systems for EV Charging Cables

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Key Words : EV(전기차), Charging cable(충전 케이블), Liquid cooling(액체 냉각), Chiller(냉각기)

ABSTRACT

In recent years, the share of EVs in the automobile market has been continuously growing. New EV models with longer ranges have contributed to those growths. The battery capacity of the previous EV models was about 50kWh~70kWh, but it is known that the recent EV models are equipped with a battery with a capacity of 100kWh. As the capacity of the EV battery increases, the problem of EV charging infrastructure has received more attention. Since the capacity of the battery has increased, a longer charging time is consumed. Therefore, 350kW HPC with higher charging capacity is being installed, and research on 500kW HPC or 1000kW HPC is in progress.

If the charging capacity increases, the heat generation also increases. Dielectric coolant is used to control the temperature of the heated area. The dielectric coolant flows in the cavity between the conductor and the sheath inside the charging cable and absorbs the heat of the cable conductor and connector. The dielectric coolant that has absorbed the heat is cooled through the chiller and recirculated through the pump.

In this study, temperature, flow rate, and pressure data of the dielectric were collected. Sensors are installed between the chiller and the charging cable to collect the data of the supply and return lines. The experiment was carried out at different ambient temperatures, and the current applied to the cable was 500A.

According to the experimental results, the cooling performance of the chiller is greatly affected by the ambient temperature. The dielectric coolant exchanges heat with the air through the radiator. When the ambient temperature is low, heat exchange occurs actively because the temperature difference with the dielectric coolant is large, but when the ambient temperature is high, the heat exchange occurs relatively little because the temperature difference with the dielectric coolant is small.

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전기차 일체형 핫스탬핑 시트크로스멤버 구조 연구

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A Study on One-piece Seat Cross Member Manufacutred by Hot-stamping Process for Electric Vehicle

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Key Words : Electric Vehicle (전기차), Center Floor (센터플로어), Seat Cross Member (시트크로스멤버), Side Crash (측면 충돌), Structural Optimization (구조 최적화), Carapace (배갑)

ABSTRACT

A Structural Study is performed to compare the newly proposed one-piece seat cross member with the existing roll-formed seat cross member in center floor system. The popularity of electric cars has been increasing, sufficient all electric range (AER) and crashworthiness are important in consumer purchase decision. Therefore, automobile brands are actively studying about lighter but still stron and safe electric vehicle. A conceptual design of one-piece seat cross member reflecting these tow newest trends is introduced and it could be calle 'Carapace System', which is named after tortoise carapace, as it no longer carries out only roles of seat cross members. Rigorous analysis on side collision test is conducted for verification of its side collision performances (IIHS MDB and side pole test through CAE program). Some strucutral improvements are also included in prevention of excessive body deformation. The material properties of body parts are incorporated into a computational analysis program simulating side collision tests. Design Factors of each component are introduced ot optimize one-piece seat corss member system. The optimized conditions are found to minimize body deformation during side crash, total weight and production cost of one-piece seat cross member system. And full details of optimized systems are presented in terms of their weights, costs and maximum intrusion position. It is concluded that one-piece seat cross member is lighter but could be slightly more expensive than existing systems, as it features a combination of components made by high-strength steel plates.

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안전장치와 림프홈 모드를 위한 전기차 파워트레인 기술 고찰

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EV Powertrain Technology Review for Fail-safe and Limp-home Mode Features

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Key Words : Electric vehicle(전기차), Powertrain(파워트레인), Limp-home mode(림프홈 모드), Transmission(변속기), Fail-safe(안전장치)

ABSTRACT

Most electric vehicles, whose sales have been explosively increasing in recent years, have a simple structure with a reduction gear in which the power transmission from the electric motor to the driving wheels. Power transmission using a gear reducer rather than a transmission has the advantages of a simple structure, high efficiency, and low cost. Conventional internal combustion engine vehicles can implement a limp-home function that restricts the vehicle's movement when an engine or drive system malfunctions through a transmission. Thus the vehicle can be moved to a nearby repair shop or towed. However, the current electric vehicle powertrain with a gear reducer is directly connected to the motor and wheels, so there is no physical disengaging device that can guarantee the safety of the drive system when a failure or abnormality occurs in the drive motor. Accordingly, in electric vehicles, fail-safe features are provided through the software of the ECU or the redundancy of chassis parts. However, due to the absence of a transmission that can physically manipulate the driving force of the electric motor, the engine control designed as a safety function is often unfavorable to deal with cases such as a sudden acceleration accident or an inconvenience to the driver due to ghost acceleration. Therefore, this study intends to examine the powertrain technology of the transmission structure that has been installed in electric vehicles recently in order to improve the vehicle dynamics performance and strengthen the safety feature.

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Risk Matrix를 활용한 전기차 화재 안전성 리스크 분석에 관한 연구

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A Study on Risk Analysis of Electric Vehicle Fire Safety Using Risk Matrix

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Key Words : Risk Management(위험관리), Risk Analysis(위험분석), Risk Matrix(위험 매트릭스), Electric Vehicle Fire Safety(전기차 화재 안전성), Machine Learning(머신러닝)

ABSTRACT

As global warming and fine dust problems become more serious, electric vehicles that are relatively free of carbon dioxide (CO2) and fine dust are emerging as an alternative to eco-friendly power generation. Interest in electric vehicles, which will become the mainstream of future eco-friendly vehicles, is increasing day by day. Major brands such as Tesla, Mercedes-Benz, BMW, and Audi are also trying to dominate the market. It seems that a bright future is promised just by looking at the situation in which electric vehicles are launched in such a fierce competition, but as the risk of fire rises to the surface, it is becoming difficult to expect a positive response.

In this study, through Risk Matrix analysis, it was confirmed that risks can be predicted by analyzing our vehicle model data when reviewing the layout of the concept stage. Also, it was possible to review the risk reduction plan through the quantification of uncertainty, and it was found that it was possible to establish effective design improvement plans within limited resources.

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전기자동차 안전성평가 기술개발에 관한 연구

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A study on the Development of Electric Vehicle Safety Evaluation Technology

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Key Words : EV inspection(전기차 검사), Electric vehicle(전기자동차) Battery management system(배터리관리시스템), EV battery(전기차 배터리), EV maintain education(전기차 교육)

ABSTRACT

In this study, in order to secure the safety of electric vehicles in preparation for the spread of electric vehicles with a carbon-neutral policy, the battery certification test was conducted by deriving the electric vehicle battery fire response technology among the main safety evaluation technology and safety management technology for the integrated safety management of electric vehicles. Establish a system and institutionalize batteries, establish a battery management system (BMS) test certification system that can monitor fire, and develop ignition prevention and delay technologies in case of fire. It is a study for deriving educational technology development for converting or expanding maintenance manpower, which was limited to existing internal combustion engines, and nurturing new manpower.

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