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Use of Lithium Ion Batteries in Electric Vehicles

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Introduction

Lithium ion batteries are a tried-and-true automotive technology, and their use in the future fleet of electric vehicles is unavoidable. Battery safety is essential for assuring confidence and widespread acceptance of electromobility in our society, in addition to battery economy and longevity. This opinion intends to shed light on the misuse of lithium ion battery rules and testing standards in electric vehicles. A key driving force for lowering carbon dioxide emissions is the replacement of traditional internal combustion engines (ICE) based on fossil fuels with "greener" and more powerful alternatives. In this regard, numerous governmental measures are being conducted all over the world to boost alternative fuel production and acceptance.

Several battery standards and regulations have been developed expressly to aid and regulate the use of batteries in electric cars. At this point, it's critical to distinguish between standards and rules. At the international level, non-governmental organisations such as the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), the Society of Automotive Engineers International (SAE), and the European Committee for Standardization (CENS) and European Committee for Electrotechnical Standardization (CENELEC) draught standards, while at the European level, the European Committee for Standardization (CENS) and European Committee for Electrotechnical Standardization (CENELEC) draught standards.National bodies (e.g., the British Standards Institution (BSI), the Japanese Industrial Standards Committee (JISC)) and regional organizations may also issue standards. State bodies, on the other hand, issue regulations that have legal force. The type approval regulations issued by the United Nations Economic Commission for Europe (UNECE) are the most applicable regulations for road vehicles. These regulations provide standardized technical requirements for wheeled vehicles, their components, and equipment, as well as criteria for reciprocal type approval recognition among several countries. The Federal Motor Vehicle Safety Standards (FMVSS) are issued by the National Highway Traffic Safety Administration (NHTSA) in the United States, and they set minimum safety performance specifications for motor vehicles and motor vehicle equipment. Laws and regulations may make reference to standards. Europe now follows the so-called New Legislative Framework (NLF), which was adopted in July 2008 and is based on the "New Approach," in which directives only mention basic criteria, with technical specifics defined in harmonized European standards referred to in these directives. Conformance to these guidelines entails compliance with the directive's basic criteria.

The NLF is covered by the Low Voltage Directive, but not yet by UNECE form approval standards for road vehicles. National type approvals are provided for in the Motor Vehicle Type Approval (EC Directives), which ensures that these approvals are recognised in other EU member states, i.e., a vehicle type certified in one EU member state can be marketed in any other EU member state. In 2012, the EU and US standards groups agreed to a Transatlantic Cooperation on Standards for Electric Vehicles to prevent the spread of rival electric car and battery safety criteria.The collaboration lays the groundwork for standardization and coordination in the area of electromobility. Others also recognized the need for such harmonization of battery specifications for automotive applications, claiming that efficiency and safety would be enhanced as a result. Testing in abusive conditions is required by battery safety requirements and regulations. Exothermic reactions (e.g., temperature increase of hundreds of degrees in seconds leading to thermal runaway) may be caused in these circumstances (e.g., overcharging, short circuit, physical deformation in a car crash). This can cause neighboring cells within a module to heat up, which, if enough heat is produced, can cause a chain reaction which propagation, and, in the worst-case scenario, result in fire and explosion. LIBs, for the most part, behave as predicted during their lifespan. However, a number of well-publicized LIB safety incidents have resulted in dangerous circumstances, making battery safety assessment a critical component of battery production. Although rare, events such as laptop fires, burning mobile phones, aeroplane accidents, GM Volt fires, and ground impacts resulting in Tesla Model S safety events enter the media far more easily than events involving existing technologies (i.e. internal combustion engine vehicle fires). Such

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incidents have resulted in product recalls (for example, Apple removed lithium ion battery packs from their PowerBook 5300 series, and the Consumer Product Safety Commission and EV Global Motors Company announced the recall of 2000 batteries in their electric bicycles), which could raise public awareness of lithium ion technology in general. Battery manufacturers, vehicle Original Equipment Manufacturers (OEMs), and transportation policymakers are concerned about the relation between safety-related events and consumer adoption of battery-powered EVs. To be approved for use in a specific application, lithium ion batteries must pass a series of safety checks (e.g. portable electronics or automotive). International, national, and regional guidelines define safety checks, which are usually based on pre-normative research and knowledge from industry, academia, and regulatory bodies. These tests are used to understand and recognize possible battery weak points and weaknesses when the battery is subjected to real-world off-normal conditions, as well as to see how the battery can respond in extreme situations like a car crash or thermal shock. Thermal runaway can occur in these circumstances. The presence of microscopic particles from manufacturing or impurities, which can pierce the separator and trigger an internal short circuit, can also cause a thermal runaway. As a result, both external and internal stimuli will cause a thermal runaway. Thermal runaway has different implications depending on State of Charge (SOC), charging/discharging rate, cell type, cell background, cathode/anode content, electrolyte composition, and other factors. Many of the experiments discussed in this study are dedicated to assessing the effects of a short circuit that could lead to thermal runaway, since this is one of the situations that could pose a significant risk to both vehicle occupants and first-aid responders. In certain experiments, such as crush, penetration, and drop tests, the short circuit is induced externally; however, other tests attempt to trigger the short circuit internally. Internal short circuit testing are controversial because creating a true internal short circuit in a laboratory environment is challenging. As a result, there is no agreement on whether the internal short circuit tests defined in current standards are "fit for purpose." There is no understanding of how the internal short circuit of a battery pack develops. Most scientific literature refers to small batteries or cells due to the high expense of the tests and the fact that the knowledge is usually private to the research bodies or the OEM. There is a scarcity of comparable evidence at the pack or full vehicle level.

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