



# Technical requirements for safe disassembly of batteries

In turn, it would exempt from the removability and replaceability requirements portable batteries where continuity of power supply is necessary and a permanent connection between the device and ...

An easy and efficient EV LIB remanufacturing is enabled by accessible electrodes of the battery modules for a quick and safe connection to the testing equipment, by reachable and non-destructive joints for a lean disassembly, by standardization and modularity of the pack architecture promoting the automation of the disassembly and testing ...

This paper showcases the integration of the Interfacing Toolbox for Robotic Arms (ITRA) with our newly developed hybrid Visual Servoing (VS) methods to automate the disassembly of electric vehicle batteries, thereby advancing sustainability and fostering a circular economy. ITRA enhances collaboration between industrial robotic arms, server ...

Through AR technology, virtual combat scenarios can be achieved, helping operators master the skills and technical points of battery disassembly, and improving work efficiency and safety. The AR-HRC system based on transfer learning can serve as a customized solution, providing personalized battery disassembly systems for enterprises.

Ensure that written standard operating procedures (SOPs) for lithium and lithium-ion powered research devices are developed and include methods to safely mitigate possible battery ...

Due to the absence of standardized specifications and configurations for retired battery packs and modules, the disassembly of battery equipment often relies on manual involvement with human operators ...

o Removability of the battery is understood to be possible when the battery can be safely taken out of a device (with or without the use of tools), in some cases resulting in the destruction of ...

Disassembly tests were executed with the demonstrator. Findings proved that semi-automated disassembly of battery systems is feasible. They have developed a concept, i.e., a workstation for more flexibility, productivity, and safety in the disassembly of LIBs, at the module level.

The design of the workcell evaluates the technological requirements for disassembly, the analysis of potentially explosive atmospheres (ATEX) of the area around the battery pack, and the design and optimisation ...

Based on this, a robot was proposed for safe and rapid battery retrieval, remaining battery quantity detection, and secondary use of retired batteries. In an actual case study of a battery pack disassembly experiment, the robotic disassembly system was found to reduce the processing time by 80-90% compared to a manual



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disassembly system.

Some scholars introduced the battery disassembly and recycling processes in terms of process improvements and technical levels. Pang ... of EV batteries on the market, the condition and safety of these batteries during recycling remain uncertain. ... sequence planning of EoL products with varying levels of scrap or disassembly requirements.

Retired electric-vehicle lithium-ion battery (EV-LIB) packs pose severe environmental hazards. Efficient recovery of these spent batteries is a significant way to achieve closed-loop lifecycle management and a green circular economy. It is crucial for carbon neutralization, and for coping with the environmental and resource challenges associated with ...

Industrial battery disassembly makes electric cars even more sustainable. The business of electric cars is booming - but what happens to the tons of used batteries? Fraunhofer Institute for Manufacturing Engineering and Automation has successfully tested how industrial battery disassembly works using the KR QUANTEC robot.

Recent advances in artificial intelligence (AI) machine learning (ML) provide new ways for addressing these problems. This study aims to provide a systematic review and ...

Serving on an electric vehicle is a tough environment for batteries--they typically undergo more than 1,000 charging/discharging incomplete cycles in 5-10 years and are subject to a wide temperatures range between -20°C and 70°C, high depth of discharge (DOD), and high rate charging and discharging (high power). When an EV battery pack ...

Disassembly automation may refer to a single disassembly cell that is able to complete the key steps of the disassembly process, such as dismantling and separation, or a system comprised of many (potentially more specialised) cells. Configuring a disassembly system as a modular system is recommended by [ ] to fulfil the economic and technical ...

The disassembly of EV batteries mostly depends on manual-involved disassembly by technical workers, owing to the complexity of uncertain disassembly objects. Considering the voltage and weight of EV batteries in ...

Various studies show that electrification, integrated into a circular economy, is crucial to reach sustainable mobility solutions. In this context, the circular use of electric vehicle batteries (EVBs) is particularly relevant because of the resource intensity during manufacturing. After reaching the end-of-life phase, EVBs can be subjected to various circular economy ...

batteries are readily removable and replaceable by the end-user at any time during the lifetime of the product.



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That obligation shall only apply to entire batteries and not to individual cells or ...

The technical requirements for the second life of retired batteries are usually less stringent than their first ones, with less-demanding requirements on their cycle and rate performance. ... etc. 116 According to the literature, the changes ...

EVs have stringent requirements for battery capacities [4, 12]. According to current standards and practices, a LIB with 70%-80% of the initial SOH should be retired from ...

Batteries 2023, 9, x FOR PEER REVIEW 15 of 27 evaluate the automation potential, which are &quot;technical ability of a disassembly process to be automated&quot; (TAA) and &quot;necessity to automate the ...

The European Parliament and Council are about to adopt an agreed text on a Regulation on Batteries and Waste Batteries ("Sustainable Batteries Regulation" or "SBR") that will impose a broad range of requirements on the safety, sustainability and circularity of batteries, including batteries that are part of devices (e.g., laptop batteries), industrial ...

In 2023, a medium-sized battery electric car was responsible for emitting over 20 t CO<sub>2</sub>-eq over its lifecycle (Figure 1B). However, it is crucial to note that if this well-known battery electric car had been a conventional thermal vehicle, its total emissions would have doubled. 6 Therefore, in 2023, the lifecycle emissions of medium-sized battery EVs were more than 40% lower than ...

An effective closed-loop recycling chain is illustrated in Figures 1 A and 1B, where valuable materials are recycled in battery gradient utilization. 9 The improper handling of batteries, in turn, has adverse impacts on both human beings and the environment. Notably, the toxic chemical substances of batteries lead to pollution of soil, water, and air, consequently ...

While HRC enables bypassing the technical challenges, the safety challenges remain. The disassembly methods of EVBs differ from the disassembly of other types of LiBs, e.g. consumer electronics LiBs such as laptops, ... of robotics and automation for battery disassembly focus on robotic control, robotic autonomy and HRC applications [14,21].

In addition, the project partners developed a flexible disassembly system that highlights non-destructive disassembly steps right down to cell level. The safety concept is an important part of the flexible disassembly system. Here, temperature is used as a possible indicator of a chain reaction in the event that a battery catches fire.

In the context of current societal challenges, such as climate neutrality, industry digitization, and circular economy, this paper addresses the importance of improving recycling practices for electric vehicle (EV)



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battery packs, with a specific focus on lithium-ion batteries (LIBs). To achieve this, the paper conducts a systematic review (using Google Scholar, ...

The aim of this project was to develop a concept for increased flexibility, productivity and safety in the disassembly of battery systems. Since a fully automated ...

With the growing requirements of retired electric vehicles (EVs), the recycling of EV batteries is being paid more and more attention to regarding its disassembly and echelon utilization to reach ...

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