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Product Architecture and Production Process of Battery Modules from Prismatic Lithium-Ion-Battery Cells

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Abstract : The electrification of the power train is a fundamental technical transition in the automotive industry and poses a major challenge for established car companies. Providing the traction energy, requiring an ever greater amount of space within the car and having a high share of value-add the lithium-ion battery is a central component of the electric power train and a completely new component to car manufacturers at the same time. Being relatively new to the automotive industry, the current design of the product architecture and production process (including manufacturing and assembling processes) of lithium-ion battery modules do not allow for an easy and cost-efficient disassembly or product design change. Yet these two requirements will increase in importance with rising sales volumes of electric cars in the near future and need to be addressed for the electric car to be competitive with conventional power train systems. This paper focuses on the current product architecture and production process of common automotive battery modules from prismatic lithium-ion battery cells to derive impacts for a remanufacturing concept. The information necessary for this purpose were gathered by literature research, patent inquiries, industry expert interviews and first-hand experiences of the authors. On the basis of these results, the underlying causes for the design´s lack of remanufacturability and flexibility with regards to product design changes are examined. In all, this paper gives an extensive and detailed overview of the state of the art of the product architecture and production process of lithium-ion battery modules from prismatic battery cells, identifies its deficiencies and derives improvement measures.

Keywords : battery module, prismatic lithium-ion battery cell, product architecture, production process, remanufacturing, flexibility
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