

PRESS RELEASE

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Efficient Small Series Production for Electromobility

Completion of the Research Project “Production Efficiency in Small-Series” (ProeK)

Laboratory for Machine Tools and
Production Engineering (WZL) of
RWTH Aachen University

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In addition to general trends and challenges in automobile production, such as shorter innovation cycles or individualization, especially electromobility is a new factor in increasing the number of variations in the production of different vehicle types. At the same time, the production volume per vehicle type is decreasing, so that production costs can be allocated to fewer and fewer vehicles. This requires efficiency enhancement measures to achieve high product quality with less effort even in small-series production. Therefore, the research project “Production Efficiency in Small-Series” (ProeK) investigated new, practice-oriented technical solutions to enable small series production in the future field of electromobility to be as cost-effective, efficient and flexible as possible.

In order to map the efficiency improvements in the production of key components, the research project was divided into two subprojects: “Shell” and “Body”. The project partners involved covered the competencies required for a successful processing of the project: Street-Scooter and e.GO Mobile (electric vehicle manufacturers), the LBBZ (component manufacturer body and joining technology expert), the FH Aachen and the Vehicle Production Department of the WZL of RWTH Aachen University (research partners) and Trumpf as an associated partner (manufacturer of laser-based production systems).

Subprojects “Body” and “Shell”

The subproject “Body” focused on reducing expenditure and conserving resources in fixture construction. The concept of jig-free joining by means of plug-in connections of the components as component-integrated jig functions was further developed based on new body components specific to electromobility, such as the battery pack housing. A corresponding alternative production chain from component manufacturing to the joining concept allows greater flexibility and material savings when using edge components and laser beam welding processes. A comprehensive design methodology was developed for the use of component-integrated jig functions instead of jigs and fixtures as additional operating resources. In addition to the plug connections, the total number of required components could be reduced by a more efficient production and joining concept for vehicle frames made of profiles.

Within the subproject “Shell” the emphasis was on reducing the effort and saving resources in quality adjustment and assurance. For this purpose, different concepts for an integrated adjustment process were investigated, for which tools for adaptive quality adjustment were developed. This included the use of additive manufactured tolerance compensation elements as well as the use of cross-linking and machine learning for the adaptive adjustment of joining processes. In the course of the second mentioned technical solution, a cost-effective sensor concept was developed, which promises significant investment and effort savings compared to the classical downstream quality assurance. The integrated adjustment process reduces scrap and rework. The reworking, which is still required, albeit less, was supported by additively manufactured gauges for the adjustment of exterior components and by tool guidance.

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Jigless laser-welded low-cost battery pack housing made of high-strength aluminium (© WZL)

In close cooperation between the partners involved, the two subprojects have thus made it possible to research solutions for more efficient small-series production along the value chain of electric vehicle production. These solutions are not only the basis for further developments by the application partners e.GO Mobile, StreetScooter and LBBZ: These solutions have already been applied in practical implementation in the corresponding productions and have led to patents, for example for additively manufactured adaptive hinges. The technical solutions developed and the corresponding implementation concepts thus make a sustainable contribution to electromobile production in NRW.

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Laboratory for Machine Tools and Production Engineering (WZL)

The Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University enhances the innovative strength and competitiveness of the industry with trend-setting basic research, applied research and the associated consulting and implementation projects in the field of production technology. In the research fields of manufacturing technology, machine tools, production engineering, gear technology as well as production metrology and quality management, practical solutions for rationalizing production are developed with industrial partners from a broad range of branches.