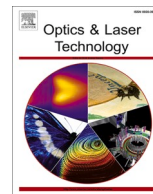


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Optics and Laser Technology

journal homepage: www.elsevier.com/locate/optlastec

Editorial

Advancing laser-based manufacturing in e-mobility[☆]

Over the past half decade, the focus on the production techniques for electric vehicles has grown rapidly. As the industrial landscape undergoes swift transformation, the electrification of mobility, particularly in the electric automobile sector, has gained considerable global momentum. The success or failure of different electric vehicles is often closely linked to the manufacturing capabilities of the brands behind them. In this context, laser-based manufacturing processes have been widely embraced as key enabling technologies for electric vehicle production.

Today, electric vehicle product specifications are becoming increasingly demanding, while economic pressure on the sector continues to intensify. As a result, a deeper understanding of laser-based manufacturing processes for electric mobility products, together with automation systems and advanced monitoring and control solutions, has become critically important. Electric mobility continues to drive the laser-based manufacturing community toward manufacturing solutions that require a comprehensive approach, spanning fundamental process understanding, optimization, and quality control, often within very short lead times.

The LaserEMobility section of AITeM – the Italian Manufacturing Association was established to address this knowledge gap as an international collaborative platform. Since 2022, the section has organized the LaserEMobility Workshop, which has become an international meeting point for both industrial and academic communities working in the field of electric vehicle manufacturing. The special issue entitled “*Advancing laser-based manufacturing in e-mobility*” presents a collection of peer-reviewed papers drawn from the broader LaserEMobility community. Contributions were invited from presentations at the LaserEMobility Workshop 2024, held in Garching, Germany, on 17–18 July 2024, as well as from open submissions by the international research community.

The contents of this special issue reflect the rapid evolution and growing demands of the electric mobility sector, providing solutions, tools, and insights across processes ranging from welding to cutting, and applications spanning electric drivetrains to lightweight body-in-white structures. The nineteen papers included in this issue highlight current trends and developments in high-power industrial lasers and their role in addressing the challenges of electric mobility. The studies investigate

materials commonly used in electric mobility applications, such as copper, aluminum and their alloys, electrical and stainless steels, as well as less explored materials including ceramics.

Across the contributions, it is evident that the research community increasingly integrates beam shaping strategies, simulation tools, monitoring techniques, and artificial intelligence methods in a complementary manner. The rich content of these works contributes to advancements ranging from process diagnostics such as X-ray imaging to the development of novel fixturing solutions that impact laser-based manufacturing processes. The authorship of the submitted works also highlights strong international collaborations and close ties between academia and industry, further underscoring the role of electric mobility as a major driving force for the laser-based manufacturing community.

As the field continues to mature, the laser-based manufacturing processes, beam shaping approaches, monitoring and control strategies, and modeling solutions developed for electric mobility are expected to enable progress in other closely related emerging sectors. Applications in energy generation will expand in response to growing global energy demand, requiring lasers for manufacturing components used at both generation and delivery stages. Similarly, the construction industry, including civil infrastructure, lightweight construction, and ship-building will benefit from the flexibility of laser-based manufacturing. Furthermore, increasing data consumption and the proliferation of electronic devices will amplify the role of lasers, particularly in micro-machining for display technologies and microchip packaging, with a trajectory toward quantum devices. The accumulated knowledge from laser-based manufacturing in electric mobility will be fundamental to advancements in these future fields.

It is hoped that readers will enjoy the contents of this special issue and that researchers worldwide will find it a valuable reference for future work. Finally, sincere appreciation is extended to the contributing authors, reviewers, editorial assistants, and the publisher for their invaluable support in the realization of this special issue.

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[☆] This article is part of a special issue entitled: ‘LaserEMobility’ published in Optics and Laser Technology.

<https://doi.org/10.1016/j.optlastec.2026.114816>

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