Lasers in Manufacturing and Materials Processing (2024) 11:1–2
https://doi.org/10.1007/s40516-024-00249-6

Editorial

Ali Gökhan Demir[1] · Alessandro Fortunato[2] · Michael F. Zaeh[3]

Published online: 28 February 2024

Electrification of mobility is a reality of today that is generating a rapid change in society and economy. By 2030, it is expected that one in every two new vehicles worldwide is foreseen to be electrically propelled. By 2040 it is forecast that up to 54% of car sales and 33% of the global car fleet will be electric [1]. Electric vehicles go beyond the automobile as trains, ships, drones, and many others are already making use of electric propulsion. Electrification also signifies a radical transformation of the production technology. Electric vehicles come with new vehicle models, novel components, and fewer parts. On the other hand, an increased variation of material thicknesses and types (Cu-, Al-, Mg-alloys, steels, and composite materials) will be used, generating the need for flexible and digital manufacturing tools. In a rapidly evolving industry of such, lasers will play a key role as flexible and digital tools for effective and sustainable manufacturing.

While the electromobility demand increases, the laser technology keeps also evolving towards an ever-increased flexibility. New beam sources are made available which provide novel beam shapes in space and time as well as new wavelengths from IR to UV at high power levels. Moreover, the laser sources are becoming more economical and robust, increasing further their appeal for industrial use. Indeed, the electromobility industry has already taken advantage of the current maturity of the laser technology for their use in several applications ranging from traction to energy storage, and vehicle body. Laser welding, cutting, heat treatment, surface structuring,

✉ Ali Gökhan Demir
aligokhan.demir@polimi.it

[1] Department of Mechanical Engineering, Politecnico di Milano, Via La Masa, 1, Milano 20156, Italy

[2] Dipartimento di Ingegneria Industriale, Università degli Studi di Bologna, Via Zamboni 33, Bologna 40126, Italy

[3] TUM School of Engineering and Design, Department of Mechanical Engineering, Institute for Machine Tools and Industrial Management (iwb), Boltzmannstrasse 15, Garching 85748, Germany

coating and enamel removal are some of the processes that have already found their industrial usage.

In a sector where new applications are developed and new laser systems are provided to the market, the need for methodological studies becomes of great importance. The laser-based manufacturing knowledge should be rapidly transferred to the industrial applications to ensure the quality and the efficiency of these processes. Indeed, process knowledge and trained personnel can become an enabler or a bottleneck for the electromobility sector, which underlines the need for a collaborative network in Europe and the world. The LaserEMobility section of AITeM—Italian Manufacturing Association was formed to fill this knowledge gap as an international collaborative group. As a core initiative of the LaserEMobility section, LaserEMobility Workshop is organized to gather the experts from research, laser component manufacturing, system integration, and application communities since 2022. The LaserEMobility Workshop 2023 was held at the Politecnico di Milano in Milan between 13 and 14 March 2023. The special issue *LaserEMobility 2023 – Lasers as enabling manufacturing tools in e-mobility* collects selected works from the Workshop invited to the journal for successive peer review. The goal of the special issue is to highlight the recent advancements in this sector and provide a reference point for researchers in the field as well as new ones who would like to have an overview of the challenges and opportunities.

The nine works collected in the special issue span various laser-based manufacturing research in the electromobility field from various parts of the world. The research themes covered emphasize welding and additive manufacturing processes exploiting in-situ diagnostics, monitoring, and process modelling methods. The application areas extend over battery systems, fuel cells, car body, and high-tension components. The processed materials include the more often investigated Cu, Al and their alloys as well as less conventional materials for the sector such as Ti, Zn, and their alloys. The presented works show methods to improve quality by means of sensor selection and machine learning in laser welding. New wavelengths and spatial beam shaping capabilities are demonstrated on hard-to-process materials. Sustainability of the processes and the products is studied through the correct process allocation and process parameter selection strategies.

We hope the readers will enjoy reading the contents of this special issue and the researchers worldwide will find relevant references for the future works. Finally, we express our gratitude to the contributing authors, reviewers, editorial assistant, and publisher for their invaluable assistance and support in bringing this issue to fruition.

Reference

1. Kampker, A., Treichel, P., Kreiskother, K.D., Krebs, M., Buning, M.K.: Ex-ante Process-FMEA for Hairpin Stator production by early prototypical production concepts. 2018 8th Int. Electr. Drives Prod. Conf. EDPC 2018 - Proc. (2019). https://doi.org/10.1109/EDPC.2018.8658288