

Lasers4MaaS' Technology Update – WMG

Lasers4MaaS is a Horizon Europe initiative focused on developing next-generation Laser-as-a-Service (LaaS) solutions for flexible, digital and sustainable manufacturing. The project brings together industrial companies, research organizations and technology providers across Europe to advance dynamic beam shaping, digital manufacturing platforms and reconfigurable laser processing systems. Through a combination of advanced laser technologies, IIoT integration and data-driven manufacturing approaches, Lasers4MaaS aims to improve flexibility, efficiency and sustainability across industrial sectors.

Within the project, WMG contributes its expertise in advanced laser welding for high-value manufacturing applications through its Centre of Excellence for Laser Welding. Equipped with high-power laser systems capable of static, quasi-static and dynamic beam shaping, WMG supports the development and validation of next-generation laser manufacturing technologies aligned with the project objectives. The organisation brings strong capabilities across the full innovation pathway, from fundamental process research to industrial validation and demonstration, supported by advanced robotic welding cells and flexible manufacturing environments replicating real industrial conditions.

As project coordinator, WMG is responsible for the overall management and coordination of the consortium while also leading several core technical developments. These include the optimisation of dynamic beam shaping laser processes, the development of advanced sensing and process-control methodologies, and the deployment of intelligent manufacturing strategies supporting the Laser-as-a-Service concept. WMG's contribution directly supports the project's reconfigure-connect-control-predict-improve-comply strategy through the development of process controller services enabling digitalised and adaptive laser manufacturing.

One of WMG's key technical activities focuses on the development of modular laser welding system setups capable of generating high-quality welding data across multiple industrial use cases. The team is actively validating beam shape optimisation strategies, plume management approaches and shielding methodologies to improve weld quality while integrating in-process sensing technologies for advanced process monitoring and control. A major milestone has been the successful application of dynamic beam shaping to significantly reduce welding defects such as porosity and spatter formation. Among the project demonstrators, WMG achieved single-pass full-penetration welding of 16 mm



SS316L stainless steel using only 9 kW of laser power, representing a major improvement in energy efficiency and process robustness compared with conventional welding approaches.

WMG is also addressing critical industrial challenges related to high-speed laser welding for battery cooling plates in electric vehicle manufacturing, where weld quality and production speed are essential. The team is investigating advanced beam-shape optimisation strategies combined with semi-analytical and high-fidelity modelling approaches to suppress humping defects and stabilise molten-pool dynamics at process speeds exceeding 400 mm/s. These developments are carried out in close collaboration with project partners including TUWIEN, IFSW, CIVAN, industrial end-users CORNAGLIA and RACE, and system integrator FFT.

The technologies developed within Lasers4MaaS target a broad range of industrial sectors including automotive e-mobility, aerospace, food packaging, pharmaceuticals and heavy industry applications such as nuclear fusion manufacturing. Through evidence-based validation of energy savings, improved weld quality and enhanced process reliability, WMG's work contributes to accelerating the industrial adoption of advanced laser manufacturing technologies while supporting more sustainable, efficient and flexible production environments.