



Project n° 101138859

DIGITAL TWINS OF LASER PROCESSING FOR MULTI-CAPABILITY MANUFACTURING OF COMPLEX COMPONENTS AND DIGITAL CERTIFICATION

Newsletter #3

Integration of different sensors to achieve hyperspectral sensing and testing the system for standard in-situ quality control

01. PBF-LB and DED-LB sensor integration and analysis

AMiquam SA, a Swiss spin-off from **ETH Zurich**, is revolutionizing quality control in metal additive manufacturing (AM) and welding processes.

Specializing in Non-Destructive Inspection (NDI), AMiquam offers advanced electromagnetic systems that enable real-time in-situ certification for metal AM, significantly reducing costs and delays associated with traditional inspection methods.

The company's innovative technology integrates seamlessly into **Laser Powder Bed Fusion (LPBF)** machines, using advanced sensors and microelectronics to provide comprehensive NDI and process information. **AMiquam's** solutions comply with established standards such as ESA/ECSS, ASTM, and ISO, ensuring the highest level of reliability. Their systems are now expanding to other advanced manufacturing techniques, including **Direct Energy Deposition (DED)** and **Friction Stir Welding (FSW)**.

As part of their ongoing projects, **AMiquam** has delivered state-of-the-art in-situ inspection systems to **DILAPRO** partners **Dublin City University (DCU)** and **Fieldmade**, which have been successfully installed on Aconity and DMG Mori PBF-LB machines. These systems open up new possibilities for inspecting previously inaccessible regions that could not be evaluated using traditional X-ray or post-process NDI.

AMiquam's integration of NDI data into monitoring systems supports corrective actions, while enhancing digital twin models for predictive maintenance.

The company is also continuing to develop its full-coverage inspection array, W2, aimed at providing comprehensive data for full part certification, further advancing the future of critical applications in advanced manufacturing.

02. DED-LB sensor deployment and analysis

To support its industrial partners on metal 3D printing CRM has put the focus on additive manufacturing of large-scale parts.

Hymax, for Hybrid and Manufacturing XI is a tailor made and unique line in Europe with a 6-axis robot, 5 different printing heads and 3 different technologies: laser powder, laser wire and arc wire. **Hymax** is unique due to its high flexibility and its large build volume. Laser to monitor the process, tools like manufacturing head and external axis can be easily added or modified.



The DILAPRO project focuses on laser technologies and mainly Laser Metal Deposition with powder at CRM.

The level of digitalization integration on this line should be upgraded to reach new standards for such equipment. A lot of information is already available but not recorded and used yet.

Within the **DILAPRO** project and more specially in **task 3.3 of WP3**, all process data will be recorded and will be an input for the digital twin. Moreover, a pyrometer, a thermal camera, a laser triangulation sensor for measuring the layer height and global geometry of the build part and a device for the control of the laser power are being implemented on **Hymax**. Those sensors and recorded data allow to have a constant global overview of process parameters and can identify any deviation in real-time.

As an example of sensor and utility, the results of tests performed with a FLIR thermal camera are shown hereunder. The camera was used as inline control system to detect over thicknesses areas which could led to geometry distortion and overheating which could led to oxidised areas. Moreover, the global thermal history of the part can be analyzed and phenomena like residual stresses or type of microstructure can be predicted.

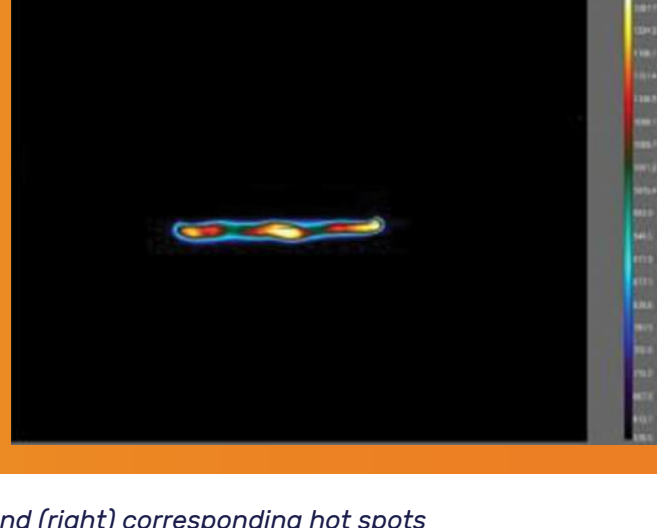


Figure 1 (left) over thicknesses and (right) corresponding hot spots

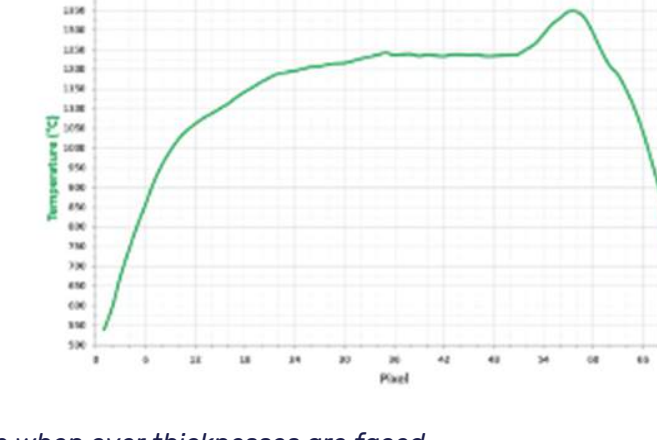
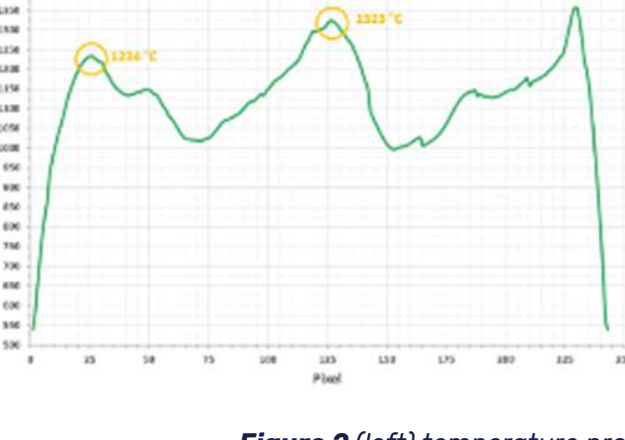


Figure 2 (left) temperature profile when over thicknesses are faced, and (right), temperature profile without over thicknesses

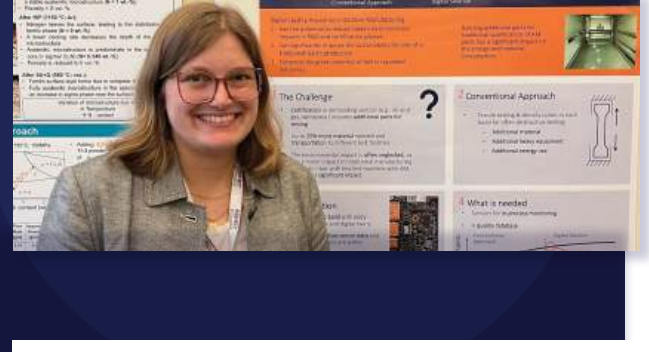
Events



4th International Conference on Key Enabling Technologies

This prestigious event brought together academics, scientific researchers, and industrial experts from various multidisciplinary fields of engineering to exchange ideas, discuss the latest scientific developments, and explore new research opportunities.

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9th Metal Additive Manufacturing Conference

Magdalena Müller presented her work on the "Hidden Environmental Impacts of Metal Additive Manufacturing in Regulated Industries."

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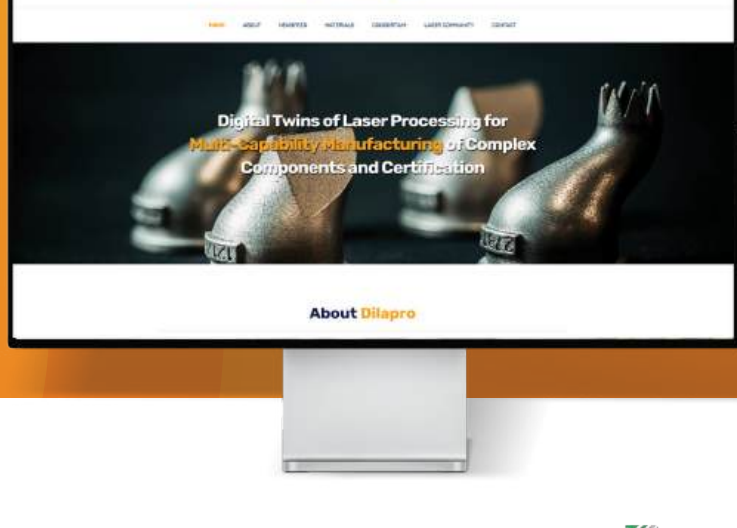


Dilapro Joins the LIMES Cluster, Part of Horizon Europe's Sustainable Manufacturing Effort

DILAPRO is now part of the LIMES cluster, an initiative funded under the Horizon Europe program.

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