“The use of additive manufacturing as a disruptive technology is becoming increasingly widespread within the industry”

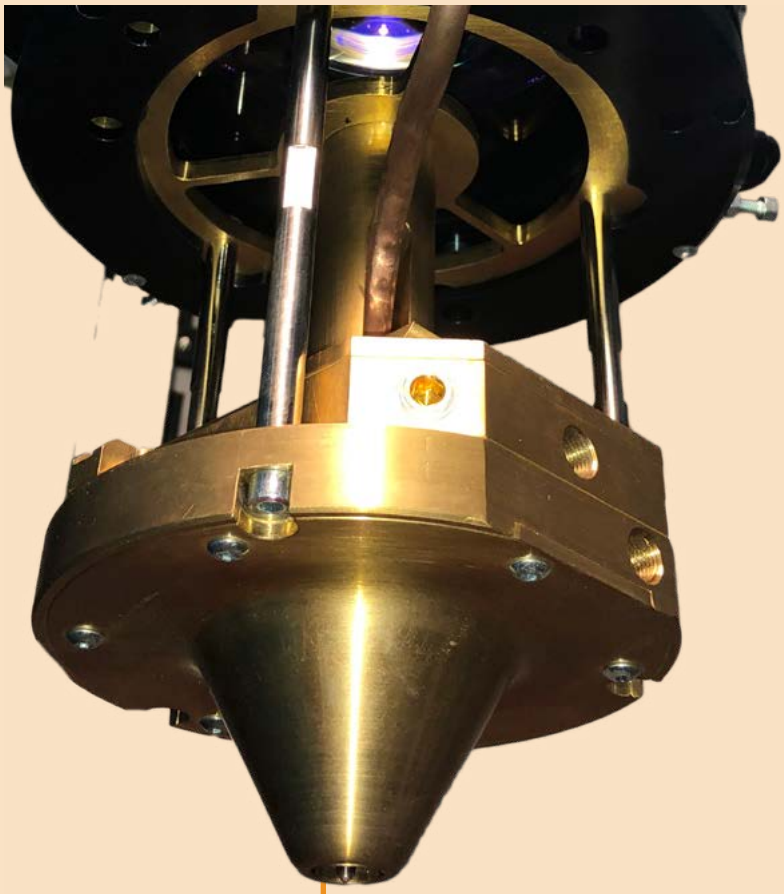
HY-MAN

Sustainable integration of hybrid additive and subtractive manufacturing for difficult-to-cut material

The use of additive manufacturing as a disruptive technology is becoming increasingly widespread within the industry. This relatively new production method, which makes it possible to manufacture products by adding material, offers many advantages compared to conventional subtractive production techniques. In the Manunet project 'HY-MAN', a consortium consisting of the partners Laser Machine Network S.r.l. (Finpiemonte, Italy), KENDU S.COOP (Basque Country, Spain), LAIP SA (Basque Country, Spain) and Politecnico di Torino (Finpiemonte, Italy), together with CNR-IMAMOTER (Finpiemonte, Italy) and Mondragon Unibertsitatea (Basque Country, Spain) as subcontractors, worked on the sustainable development and production of difficult-to-cut materials. Giuseppe Savant Aira, project coordinator and working for Laser Machine Network: "At the moment there are few machines based on wire deposition available, especially in Europe. As a project consortium, we wanted to invest in the development of LMWD (Laser Metal Wire Deposition) and LAMWD (Laser Arc Metal Wire Deposition) technology in order to act as one of the few manufacturers of such machines in the marketplace. To achieve this, during the Manunet project we investigated the reliability of additive manufactured materials and components, including the development and integration of equipment that forms the core of an AM machine. This project was a fundamental step for us to expand our skills in additive manufacturing."

Automotive and aerospace applications

Using Additive Manufacturing (AM), components can be made from materials classified as difficult to manufacture using conventionally applied industrial processes such as forging or machining. However, particularly for metal parts, additive manufacturing technologies appear to be relatively expensive, do not meet the required standards and are therefore less suitable for mass production. “The aim of the project is therefore to achieve sustainable development and production of steel and titanium alloys by using AM technologies characterised by high deposition rates such as LMWD (Laser Metal Wire Deposition) and LAMWD (Laser Arc Metal Wire Deposition),” says Savant Aira. “The advantage of these wire-based processes can be seen in the relatively good material properties and the possibility of unlimited construction volumes. By using additive manufacturing, production costs can be reduced because the use of materials is more efficient and the number of machining runs is reduced. Moreover, by intelligently combining subtractive and additive systems in, for example, a hybrid or integrated system, post-processing can take place smoothly. As a result, the surface finish is better than when only pure AM processes are used. The application of these wire-based processes to difficult-to-cut materials is particularly interesting in the production of medium to large components for moulds, automotive and aerospace applications.”



Higher deposition rates and improved topology

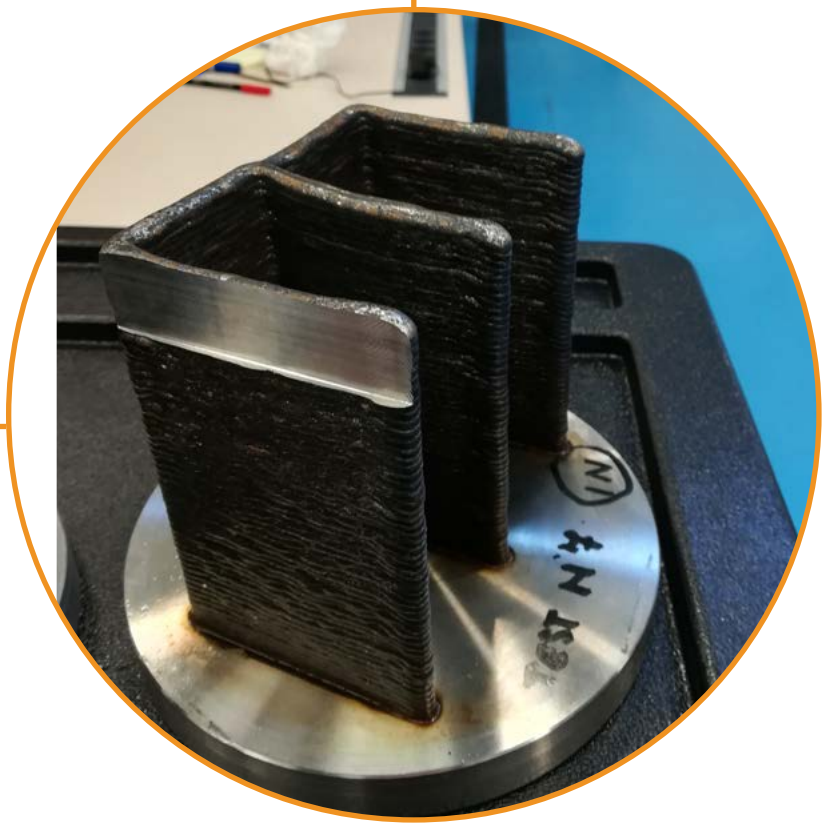
“During the project, we were able to design and further optimise the AM wire processes, both in terms of equipment and process parameters for achieving good material properties,” says Savant Aira. For the LMWD process, a coaxial printhead was designed to enable directional independence for all welding positions. This is important, because it generates more flexibility and makes it easier to produce more complex geometric shapes.

“In the project we demonstrated that by using the LAMWD process a higher deposition rate could be achieved. The addition of the laser also improved the topology of the printed layers. For example, during the innovation project various structures with a wide variety of wall thicknesses (from 1 to 25 mm) were generated to test the suitability of the processes for building a real part geometry. These samples were then analysed by comparing structure, machinability and mechanical properties with the raw materials.” Despite the presence of some pores as a result of the production process, the density was promising and the tensile strength was comparable to that of the raw material. “We are of course very pleased with this result,” Savant Aira emphasizes.

Improved topology of printed layers

Sustainability as a social challenge

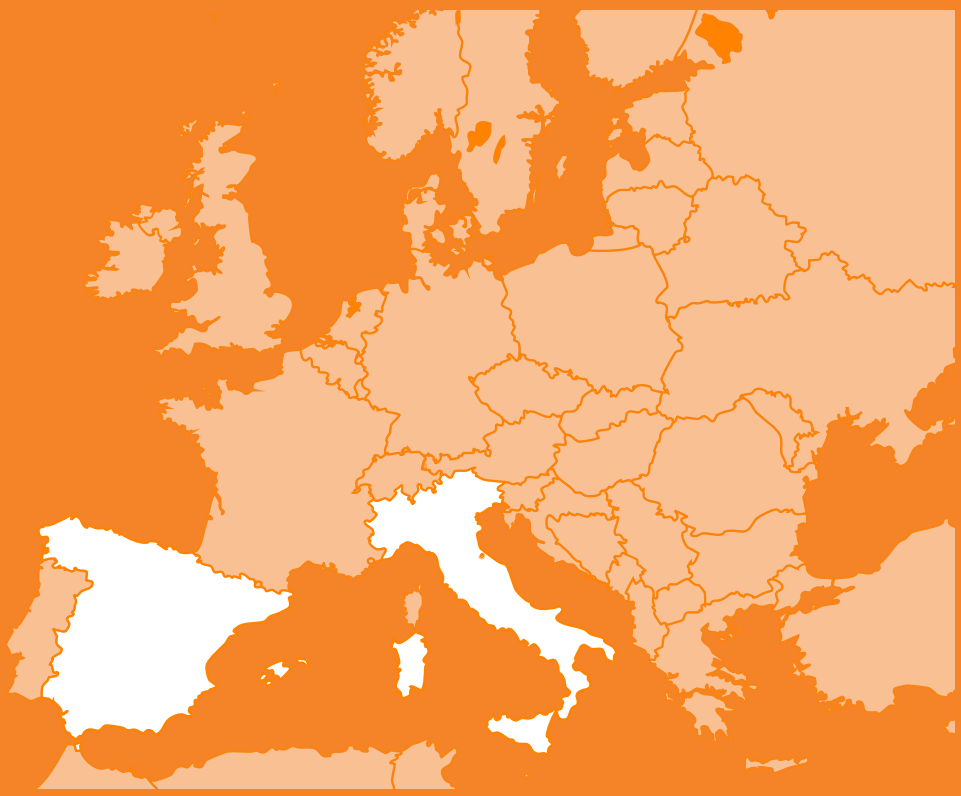
“The aim of optimising rapid additive production technologies that reduce environmental impact was a crucial aspect of our project,” explains Savant Aira. “For example, we applied a full life cycle analysis to identify the advantages and limitations of AM technologies compared to conventional subtractive technologies in terms of sustainability.” The advantage of a production technology such as additive manufacturing is not only that it allows more complex geometry and faster production of personalised parts, but above all that it reduces the amount of material waste and enables the development of robust lightweight components. Particularly within the automotive and aerospace industries, there is a high demand for such components, as they can reduce the weight of vehicles and thus reduce CO2 emissions. According to Savant Aira, the need for sustainable development of large components cannot ignore the integration of additive technologies (such as LMWD and LAMWD) and conventional subtractive production techniques.



Experimenting with new cross-border collaborations

"The Manunet framework has given us the opportunity to set up innovative activities. We are used to commercial cooperation in Europe and worldwide, but the programme allows us to experiment with new collaborations between foreign partners with similar objectives. The cooperation with all partners has been fruitful, with a focus on developing a joint approach and sharing expertise. With our proactive approach, we have been able to solve the various technical challenges, which has allowed us to achieve encouraging results."

Giuseppe Savant Aira



Acronym
HY-MAN

Call
Call 2017

Coordinating Funding Agency
FINPIEMONTE S.p.A

Participating partners
Laser Machine Network S.r.l. (Finpiemonte, Italy)
KENDU S.COOP (Basque Country, Spain)
LAIP SA (Basque Country, Spain)
Politecnico di Torino (Finpiemonte, Italy)

Project duration
18 months

Total project cost
€ 1.046.358

Contact
Laser Machine Network S.r.l.
Giuseppe Savant Aira
(39)0124371829
giuseppe.savant@laserlmn.com
http://www.laserlmn.com

"As funding agency 'Finpiemonte' we have been closely involved in the support of the HY-MAN project. Communication and coordination were profitable and we are very pleased to have been part of the innovation process of our beneficiaries"

Enrica La Martina - FINPIEMONTE S.p.A

"As funding agency of the regional government Finpiemonte is aimed to enhance the competitiveness of our territory and to promote innovation. We have been partner of Manunet for many years and we really appreciate its effectiveness in supporting our companies in improving their skills and know-how through innovative, solid and lasting transnational networks"

Marco Milanesio - FINPIEMONTE S.p.A