



13-11 YDAS

Newsletter 7

Cladding process optimization through process simulation and DOE.



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After several months of work, the second task of R3-MYDAS Oil&Gas Use Case is almost complete. This task has been structured in two main activities, each designed to deepen our understanding of the cladding process and its impact on the final component’s performance.

Design of Experiments

The first activity focuses on the development of and execution of comprehensive Design of Experiments (DOE). The objective was to systematically study how key process parameters — laser power, scanning speed, preheating temperature and powder federate — influence critical responses of the deposited material.

By varying these parameters within controlled ranges, we analyzed their effects on several measurable outputs, including hardness in the clad, HAZ, bead width, bead height, and more. This structured approach has provided valuable insights into the relationship between input conditions and resulting material properties.

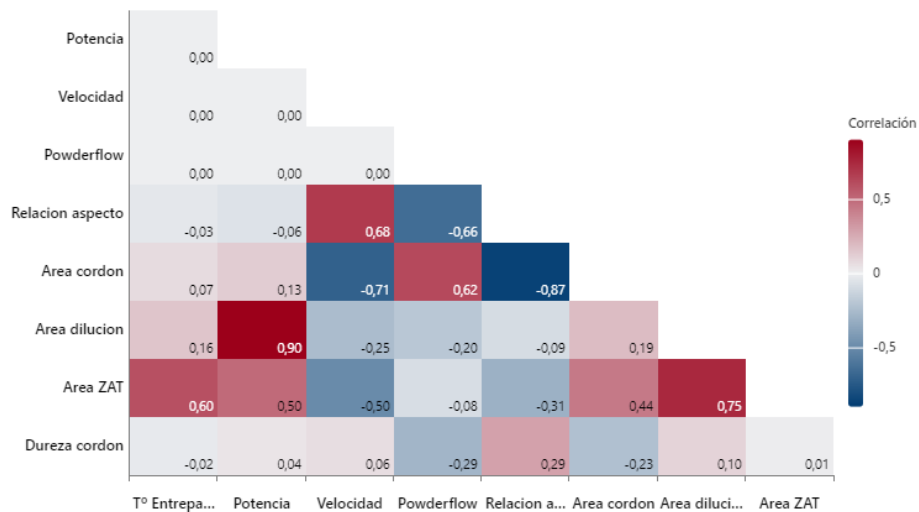


Illustration *Error! Bookmark not defined.* Correlogram

Cooling rate study – Towards reducing preheating requirements

In parallel, a dedicated study was carried out to investigate the relationship between cooling rates in the HAZ and the resulting hardness. This analysis aimed to identify the thermal conditions that directly affect microstructural evolution and mechanical performance.

Through detailed monitoring and analysis, we have been able to establish correlations between the cooling rate and the hardness obtained in the HAZ. These findings open the door to defining an optimal cooling rate range that prevents excessive hardening or brittleness. Importantly, this approach may reduce or even eliminate the requirement for preheating, which would represent

a significant improvement in terms of energy efficiency, process simplification and overall sustainability.

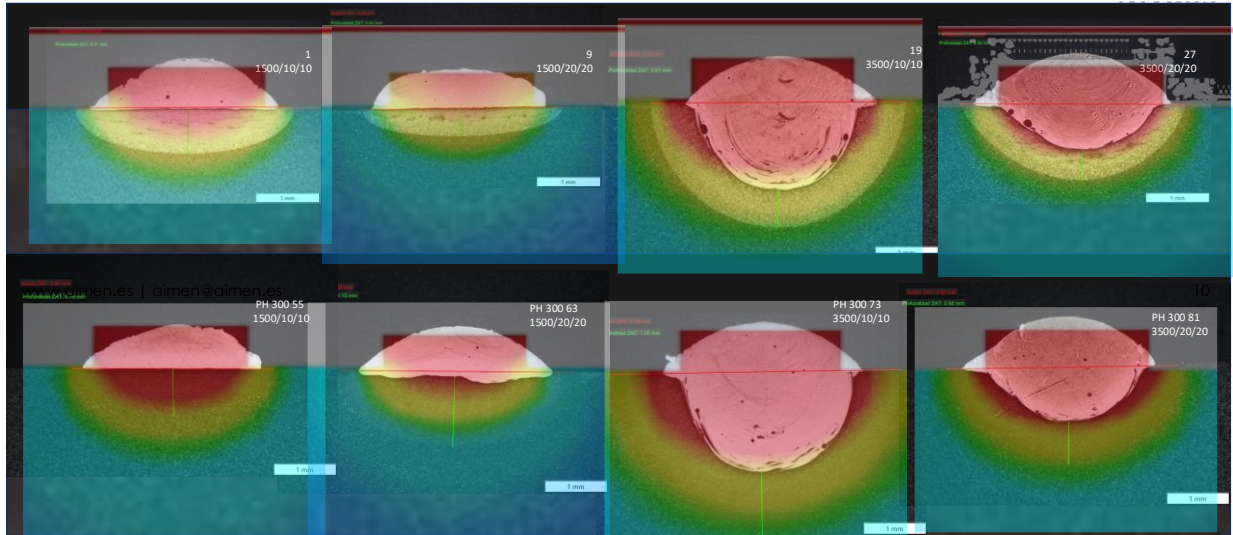


Illustration 1. Thermal track correlation.

The knowledge gained from the DOE and the cooling rate study will soon be consolidated into actionable guidelines for cladding process optimization. These outcomes will not only support the current case study but also provide a strong foundation for extending the methodology to other laser cladding applications.