Success Story
Automotive

GKN ADDITIVE

Industrialization of the Laser Powder Bed Fusion Process Using the EOS M 300-4

Source: GKN Additive

GKN production: The EOS M 300-4 forms an optimal basis in physical and digital interfaces for further accelerating the industrialization of additive manufacturing processes (especially the L-PBF process).

Challenge

Additive manufacturing with extensive automation in order to facilitate more comprehensive industrialization

Solution

Use of digitization in the overall process through the interfaces of the EOS M 300-4, incorporating the capacity of the multi-laser system

Results

Digital: The OPC UA interface of EOSCONNECT Core facilitates connectivity to monitoring and business intelligence solutions

Automated: Deep process and software integration form the basis for extensive industrialization

Reliable: Few secondary processing times, and reproducible high part quality

How GKN Additive and EOS **Combine Digitalization, Automation and the L-PBF Process**

Digitalization is on everyone's mind. Certainly, we still spend too little time looking into industrialization which links digitization with additive manufacturing methods. This is precisely where automation and integration of data can lead to a deeper understanding of the process, making leaner additive manufacturing possible for the first time. GKN Additive, using the EOS M 300-4 system, is demonstrating how well this is already happening and what the advantages are.

Challenge

As experts in the additive manufacturing (AM) field for many years, and with its fleet of machinery, including laser powder bed fusion (L-PBF), multi-jet fusion and metal binder jetting systems, GKN has the necessary experience and comprehensive expertise in all these technologies. With this know-how in place, it made sense to deepen it within the IDAM funding project, primarily in the automotive industry, and especially for after-market and spare parts. The goal of the project is to promote industrialization and thus to lay the groundwork for future, more intensive automation and digitization along the AM process chain. This has resulted in a demanding list of criteria for selecting a L-PBF manufacturing system.

The new AM system needed to achieve the benchmark high quality level of parts but also had to ensure a very stable, powder-based industrial 3D printing process. However, what was most essential was to provide standardized digital interfaces (for example OPC UA) in order to facilitate seamless integration into digital processes, from monitoring to predictive maintenance to automated controls. The module for introducing metal powder (the dispenser) should guarantee flexibility in materials used so that gas-atomized as well as water-atomized powder materials can be used.

In order to achieve industrialization with the desired high system productivity, the use of a high-performance multi-laser system was advisable, which the EOS M 300-4 offers. Another reason for selecting the EOS M 300-4 was its full-field function: each of the four lasers is capable of performing platform-overlapping exposure ("full-field overlap"). Since the modularly designed manufacturing system ensured a physical interface along with the required digital interfaces, it was a clear choice for GKN.

Structural components for the automobile sector, manufactured using the EOS M 300-4.
(Source: GKN Additive)

Short Profile

GKN Additive is a globally active manufacturer of innovative, additively manufactured metal components and materials for prototypes, mid-volume up to high-volume series and for the after-market. The company is striving to push the envelope in the development of new technologies in order to make them accessible to the market more easily and more quickly. GKN Additive is supported by GKN Powder Metallurgy know-how in the areas of powder manufacturing and metal processing, and by an engineering network of over 6000 associates at 29 locations.

More information
www.gknpm.com/additive

Solution

Such a complex and far-reaching scenario means integration of more than "just" one new production machine in a running production process. GKN began with intensive testing of the system: investigation of component quality, analysis of multi-laser strategies and intensive evaluation of the overall process. The strategies that allow the four lasers to be most effectively utilized – load balancing, swimlane or quadrants – were also investigated.

Generic build job manufactured on the EOS M 300-4, consisting of test specimens for analyzing mechanical properties, density and resultant surface roughness.
(Source: GKN Additive)

The capability of the L-PBF production process was critically analyzed from the start regarding density, mechanical properties and surfaces. In this regard, GKN focused on proprietary material development: dual-phase low alloy steel (DPLA). Close collaboration with EOS and Additive Minds accelerated the first steps in DPLA material qualification. Based on the findings from single laser studies, GKN was able to rapidly advance the capability of the DPLA material on the EOS M 300-4 system and was ultimately successful.

In addition to process parameter development, for the purposes of constantly monitoring system performance, the EOS M 300-4 process data is monitored and evaluated using internal GKN software (including Business Intelligence Systems, among others). "Providing an OPC UA interface guarantees a continuous flow of data, which supports us in our technical evaluation of the process and of the resulting system efficiency," said Sebastian Blümer, Technology Manager Laser AM, GKN Additive. "Eye-to-eye collaboration with EOS has made it possible for us to optimize the utilization of physical and digital interfaces even more. In addition to data monitoring, it is now possible to send commands which control the EOS M 300-4, and thus to lay the groundwork for an automated system."

Results

The current results have already proven that GKN selected the right approach and the right EOS hardware. Since GKN also uses the EOS M 290 in its machinery, it was possible to compare both systems with regards to achievable quality and productivity. As expected, the multi-laser system fully utilizes its advantages here. This superiority was also on display for the "long haul": GKN established high availability, among other things regarding generic machine protection (selection of job layout, based on the findings of the Joint Working Group (JG 79) - in line with ISO TC 261). A one-piece build job was printed in 160 hours at a 35 percent nesting density and, all four lasers were permanently active. In follow-up, focus was placed on testing the robustness of the system and on analyzing the required component quality claims. The result was that the system is very durable in continuous operation and produces a high and reproducible component quality over a long build job timeframe.

"The comprehensive qualification of the EOS M 300-4 system was the basis for the automation of the machine and for the industrialization of the L-PBF process sought with its use. The EOS M 300-4 already has proprietary hardware for automatically handling build platform carriers. In this way, we utilize the full potential of the system in order to service small- and large volume projects in the future more quickly." summarized Sebastian Blümer. This increases the number of potential applications, e.g. complex sheet metal geometries/designs are now possible with this solution package.

„Reproducible part characteristics and a reliable process environment are the primary advantages of the EOS M 300-4 multi-laser system. So far, we have successfully printed 120 build jobs in the first year. The performance of the machine, and its modular concept, plays a key role for our industrialization strategy."

Sebastian Blümer, Technology Manager Laser AM, GKN Additive

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