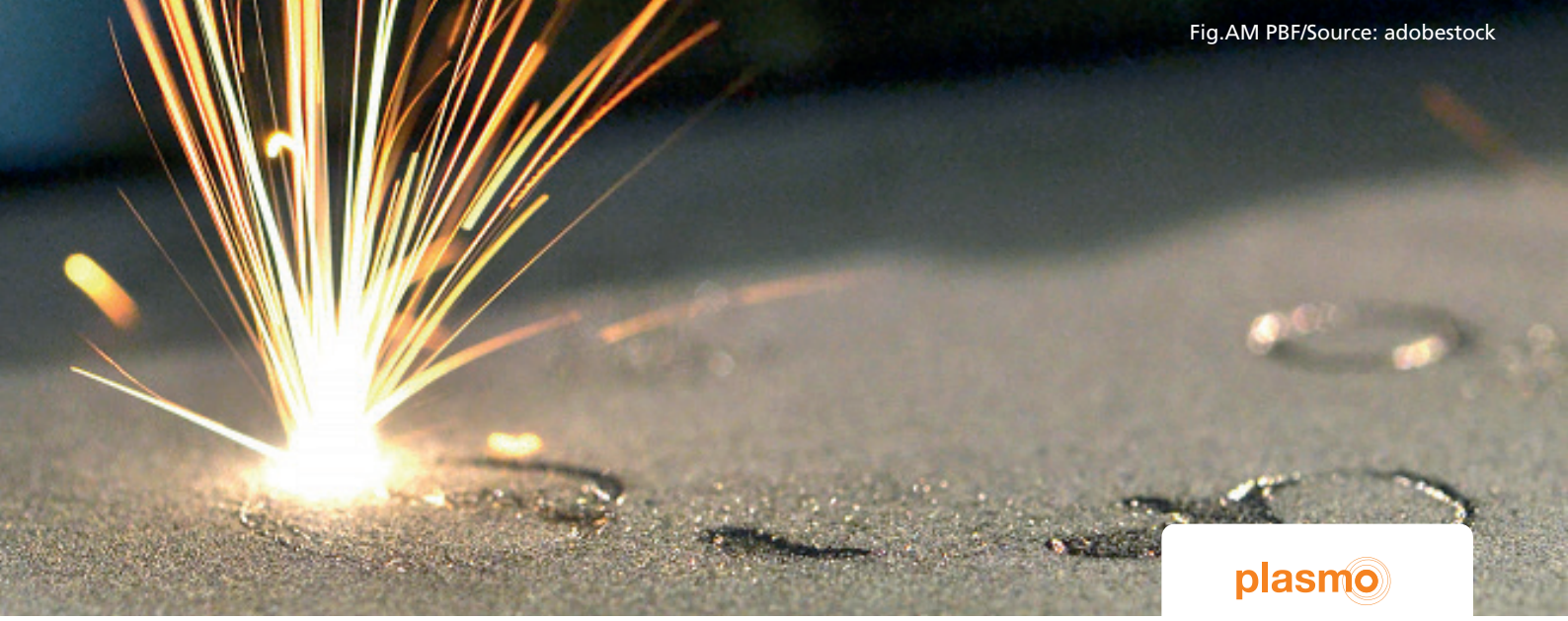


Fig.AM PBF/Source: adobestock

QUALITY ASSURANCE IN ADDITIVE MANUFACTURING

An overview of plasmo solutions for 3D printing

Our customers use the associated freedom in component design as well as the rapid feasibility in prototype construction with additive processes. Additive manufacturing with metals or plastics offer companies new possibilities with a high degree of geometric flexibility. In order to make optimal use of the manufacturing process in series production, essential prerequisites must be fulfilled.

plasmo helps to better understand these manufacturing processes and provides deep insights into the respective components with its quality assurance solutions.

In addition to an understanding of the manufacturing processes, knowledge of achievable possibilities, component direction-dependent mechanical-technological properties and the application of suitable quality assurance systems is indispensable. In this way, defective parts can be detected when they occur. The additive processes are used in sectors such as aerospace, energy technology, petrochemical, automotive, tool- and mold making, and medical technology.

plasmo's many years of experience in the field of thermal joining processes can be transferred to additive manufacturing applications. The special adaptation of the QA systems for additive manufacturing has been developed and implemented at plasmo since 2010 and supported in many cooperation projects with industrial and scientific partners. Commercial plasmo systems have been in use on the market in the Powder Bed Fusion segment since 2016.

plasmo quality assurance systems support customers to not only provide the necessary safety but also offer many other advantages such as the reduction of testing costs. This contributes to plasmo's clear vision for the future: to develop new concepts together with system manufacturers for the two application areas of Powder Bed Fusion and Direct Energy Deposition. In addition to more intelligent construction processes (e.g. feedforward control), plasmo is working with system manufacturers and the scientific community on the faster, sustainable qualification of processes and their standardization.

Additive processes – PBF and DED

Additive manufacturing processes can be divided into powder bed-based processes (Powder Bed Fusion/PBF) and direct energy deposition (DED) processes - e.g.

laser metal deposition or wire-based processes. Which manufacturing process is used depends, for example, on the size of the structures of the components. PBF enables smaller structures with smaller volumes while DED processes usually enable larger volumes with higher application/deposition rates.

Due to the complexity of the tasks in both 3D printing processes, quality assurance is important and is a standard requirement for many companies. Quality criteria such as strength, dimensional accuracy, and surface quality can, depending on process parameters and requirements, be comparable in both processes. However, the different manufacturing processes require different QA systems based on the same physical principles.

Quality Assurance for Powder Bed Fusion (PBF)

For the PBF process, several quality monitoring systems were developed in cooperation with EOS and successfully placed on the market: EOSTATE PowderBed, EOSTATE MeltPool and EOSTATE Exposure OT.

These offer deep insights into the respective components in real-time. In this way, component defects can be identified and the construction process can be stopped when a defect is detected.

EOSTATE PowderBed monitors the powder application in each layer by means of a camera and the correct exposure process after it has been completed, thus enabling control of the powder quantity applied.

EOSTATE MeltPool records the process emissions in the visible and near infrared range and thus enables the detection of process irregularities with the highest geometric and temporal resolution.

EOSTATE Exposure OT determines the temperature radiation of the construction process of the applied layer in the near infrared range and detects process

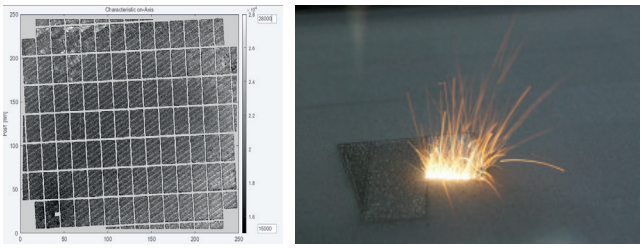


Fig.: Meltpool Monitoring/Source: EOS, plasmo

irregularities in the thermal image of the exposure process including the thermal memory of the underlying layers.

Quality assurance for deposition welding (DED)

In the Direct Energy Deposition process, plasmo systems enable the detection of process irregularities through sensor- and camera-based technologies (process**observer**, plasmo**eye**, profile**observer**). Furthermore, processing positions as well as plant and process parameters are recorded.

The process**observer** records the process emissions in the visible and near infrared range and thus enables the detection of errors or deviations.

The camera-based system „plasmo**eye**“ enables the visual representation and documentation of the DED process in real time, whereby parameters such as melt pool and/or dimensions are detected. Using ca-

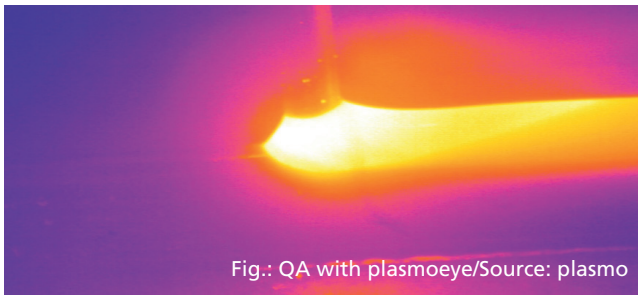


Fig.: QA with plasmoeye/Source: plasmo

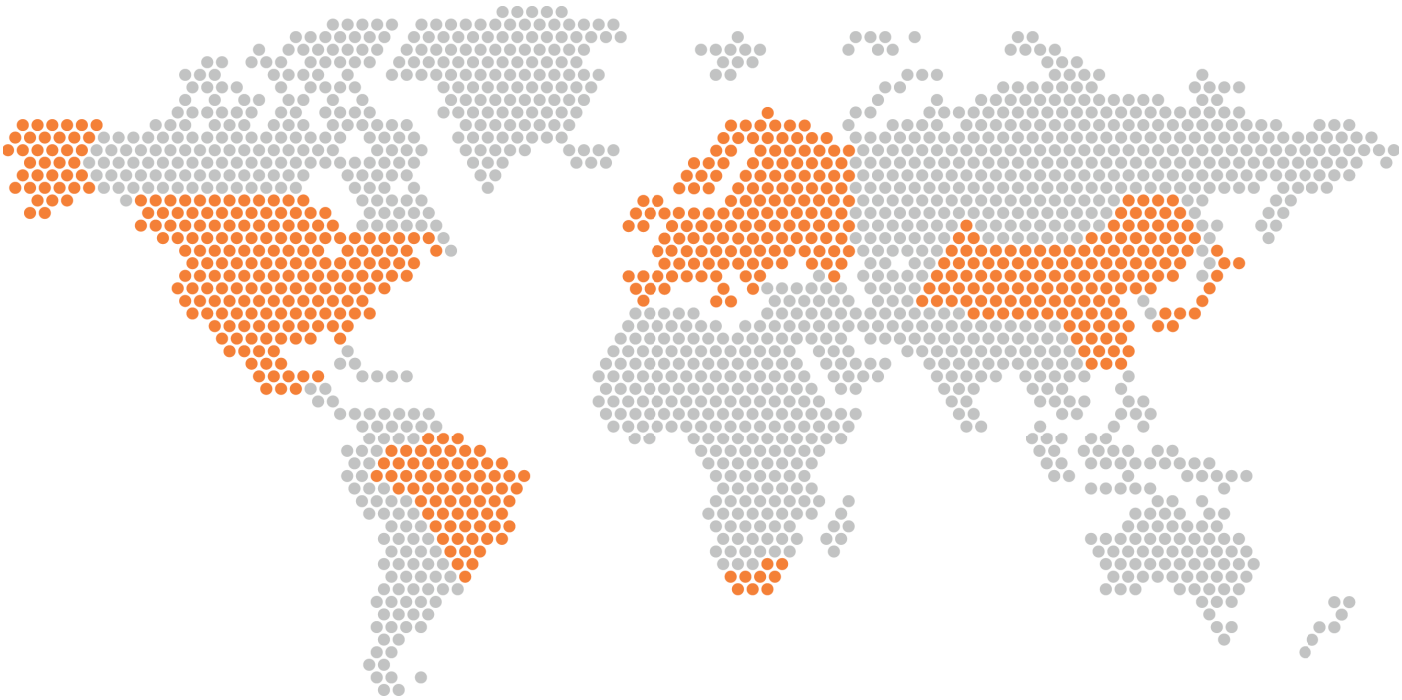
meras in the near infrared range, temperature distribution and cooling in the solidified area are evaluated in order to draw conclusions about the quality. Furthermore, possibilities for closed-loop control are developed by recording the IR spectrum.

With the plasmo profile**observer**, the geometry per layer/layer or the geometry of the entire component

is determined. This makes it possible to check the position of the processing head from layer to layer as well as the dimensional accuracy and number of layers required. Depending on the quality criteria the different plasmo inspection systems can be flexibly combined in order to find the appropriate inspection method for DED procedures for the most diverse applications.

Here you will find further information on our individual products:
www.plasmo.eu/en

APPLICATION QA for 3D printing
PROCESS AM PBF and DED
POSITION inline, post process
PLASMO SOLUTION process-, profilobserver, plasmoeye
TECHNOLOGY camera- and diode-based



plasmo Industrietechnik GmbH (Headquarter)
Dresdner Str. 81-85
1200 Vienna, Austria
Phone +43 1 236 2607-0
sales@plasmo.eu
www.plasmo.eu

plasmo Industrietechnik GmbH (German Branch)
Leitzstr. 45
70469 Stuttgart, Germany
Phone +49 711 49066-307
sales@plasmo.eu
www.plasmo.eu

plasmo USA LLC
44160 Plymouth Oaks Blvd.
Plymouth MI 48170, USA
Phone +1 734 414 7912
sales@plasmo-us.com
www.plasmo-us.com

plasmo China Co.,Ltd
42F Wheelock Square
1717 Nanjing West Road
Shanghai 200040/P.R.China
Phone +86 21 8028 6166
sales@plasmo.cn
www.plasmo.cn