

Choosing the right process for the right application

(A technical article from 2023, author: Max Wissing, Technology Manager Additive Manufacturing, PROTIQ GmbH, Blomberg)

3D printing or conventional manufacturing after all? How to find the right process for your next project and how online platforms can help

The technology of additive manufacturing processes, commonly referred to as 3D printing, has become established in more and more industries in recent years. Unlike in its early days, the technology has long since ceased to encompass only the rapid production of initial plastic prototypes. A wide range of processes and materials enables, among other things, the production of heavy-duty metal parts, series-production plastic items, or even components made of high-purity ceramics or quartz glass.

What all additive manufacturing processes have in common is that the parts are built up layer by layer by adding material, without the need for a forming tool. This fundamentally distinguishes the technology from conventional industrial manufacturing processes such as CNC turning and milling, forming, or casting, and gives it a very high degree of flexibility. The parts are produced directly from the 3D CAD data, so production can begin immediately. The layer-by-layer build-up allows for particularly high design freedom and the production of very complex parts.

For the user, additive manufacturing takes its place alongside conventional processes in the existing process portfolio and complements it with its unique properties and advantages. At the same time, the many 3D printing processes differ considerably from one another in their properties and the materials they can process. The pro-



cesses are distinguished from one another by the type of layer build-up and the feedstock used.

The FDM process (Fused Deposition Modeling), which is very widespread above all in the private sector, is based on melting a plastic filament that is deposited locally through a fine nozzle. The process is inexpensive but offers low part strength and limited detail reproduction. Due to its limited productivity, it is better suited to small quantities and parts without high quality requirements.

For additive manufacturing that meets industrial requirements, resin-based and powder-based processes are primarily used.

The resin-based additive process, e.g., stereolithography (SLA), enables the production of the best detail and surface qualities. The parts are created from liquid, photoreactive synthetic resin, which is cured layer by layer by a precise UV light source. The parts are very precise but have so far always had low strength and ductility, so that they could only be used for prototypes. Thanks to newly developed resins, however, heavy-duty series-production parts can now be produced with this process as well.

In the field of powder bed-based additive manufacturing processes for producing plastic parts, the two processes

ABKÜRZUNGEN

Micro Selective Lasermelting (Micro SLM)
Lithography-based Metal Manufacturing (LMM)
Selectives Laserschmelzen (SLM)
Selectives Lasersintern (SLS)
Fused Deposition Modeling (FDM)
Stereolithographie (SLA)
Multijet Fusion (MJF)

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of selective laser sintering (SLS) and Multijet Fusion (MJF) dominate the market. In both processes, the parts are produced from fine plastic powder that is melted locally by a powerful light source (laser or radiant heater). During the printing process, the parts are surrounded by unmelted powder, so support structures are not required. As a result, the process offers high productivity, and significantly finer details, higher strengths, and greater complexity can be achieved. The parts are particularly suitable for mechanically stressed components and can also be used for series applications.

For the production of even more heavy-duty metal parts, the very similar process of selective laser melting (SLM), also known as laser powder bed fusion (L-PBF), is used. As with the SLS process, fine powder, in this case metal powder, is likewise fused together using a very powerful laser.

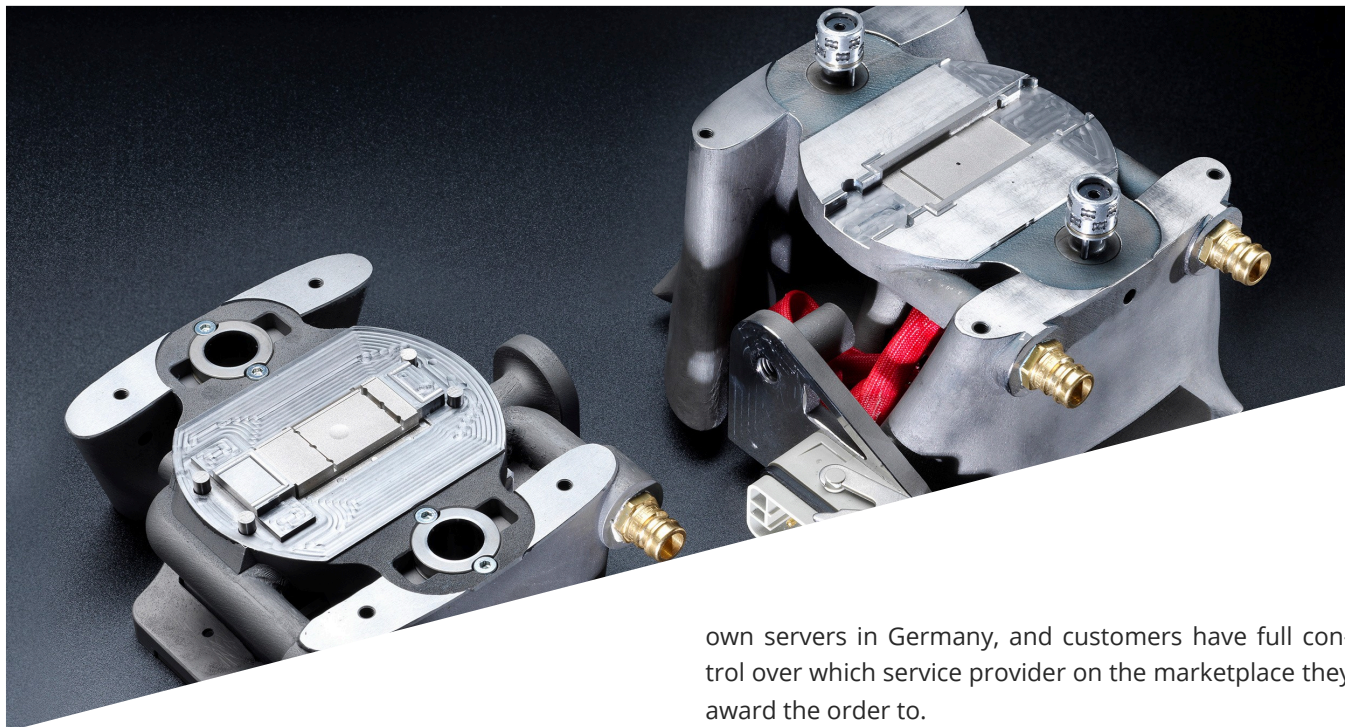
The available range of materials extends from a variety of high-strength steels through light metals such as aluminum and titanium to special materials such as zinc and copper. The potential fields of application, especially in additive metal manufacturing, are diverse, as the material properties of the parts are comparable to those achieved with conventional manufacturing processes. Typical fields of application for parts made with this

process include lightweight design in the aerospace industry, custom components in mechanical engineering, and complex heating tools and molds.

At the same time, additive manufacturing is undergoing rapid, ongoing development, opening up new possibilities and potential year after year. Innovations in the available plastic materials now make it possible to produce parts from genuine silicone or with flame-retardant and ESD-dissipative properties.

New metal materials such as pure copper or the series material Zamak 5 (zinc) offer new opportunities for current-carrying applications or direct series production in combination with zinc die casting. Innovative additive manufacturing processes combine the advantages of resin 3D printing with the production of highly detailed parts made of technical ceramics, pure quartz glass, or high-strength metal parts.

Due to the highly dynamic development, however, it is becoming increasingly difficult for users to keep track and to evaluate and tap new potential. Of course, additive manufacturing must always be viewed and assessed in relation to conventional manufacturing processes. Only if an individual use case proves more economical with additive manufacturing processes than with other manufacturing processes can it be implemented sensi-



bly. This is usually the case for small and medium quantities or for complex part geometries.

An additional decisive criterion for the use of additive manufacturing is the forecast of being able to ensure sufficient capacity utilization to cover the high investment in equipment. Manufacturing service providers specializing in additive manufacturing and online platforms such as the PROTIQ Marketplace offer a flexible alternative to investing in one's own machines.

The online marketplace offers its customers a wide range of additive manufacturing processes and materials that a single company could not cover on its own. With the online marketplace, PROTIQ GmbH, which gives the platform its name, specifically addresses the quality requirements and needs of industrial customers. Unlike other comparable online platforms, transparency and data security are a particular focus here. The data uploaded to www.protiq.com is stored on the company's

own servers in Germany, and customers have full control over which service provider on the marketplace they award the order to.

Thanks to fully automated price calculation, customers can compare the different processes, materials, and manufacturing service providers immediately after uploading the 3D CAD data of the parts to be manufactured. This enables a direct, quantity-dependent comparison with other manufacturing processes. The choice of an available manufacturing partner is further supported by a review and star rating system.

In addition, PROTIQ offers competent, personal consultation to clarify the individual requirements and boundary conditions for the possible additive manufacturing of the respective parts.

Further information:

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