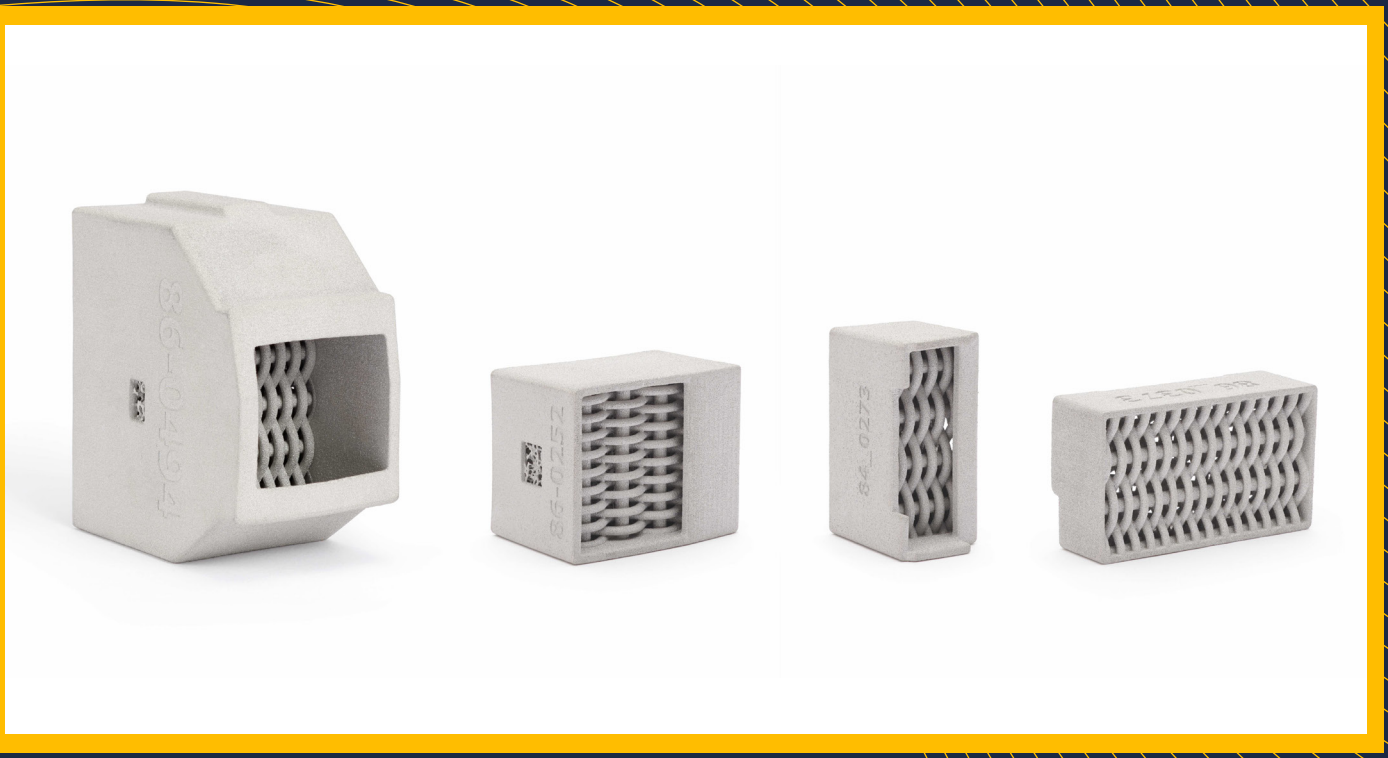
GKN ADDITIVE
FORECAST 3D

Schneider Electric

Customer Case Study



Enabling 3D Metal Printing on an Industrial Scale

GKN Powder Metallurgy's Additive Division Produces Filters for Schneider Electric

In early 2022, Schneider Electric™, the global leader in the digital transformation of energy management and automation, was looking for a way to manufacture special filters for use in its circuit breakers. GKN Additive (Forecast 3D) provided the solution: binder jetting technology for 3D metal printing on an industrial scale.

Traditional Manufacturing Meant Limited Applications

Schneider Electric wanted to deploy its ComPacT® circuit breakers into large-scale plants and marine applications. In case of a short circuit, special filters for the circuit breakers capture the ionized particles and reduce the gas exhaust pressure and temperature induced by the electric arc.

The filters must withstand extreme temperatures and high pressure due to plasma, among other things. However, the sheet-metal-assembly filters Schneider Electric originally used were only suitable for these conditions to a limited extent.

Schneider Electric tested various manufacturing processes, but none of them provided the required performance. Laser sintering produced better results, but it proved too costly for series production due to the complex filter structures. In addition, the de-powdering of the filter turned out to be problematic in the binder jetting process.

Agile Development Allows for Innovation

HP brought GKN Additive into play. As part of GKN Powder Metallurgy, GKN Additive has extensive metallurgical knowledge and expertise in additive manufacturing (AM), metal injection molding, and metal sintering — from prototype to series production.

After several iterations, GKN Additive and Schneider Electric created a new organically shaped filter mesh that could easily be de-powdered after 3D printing while meeting all of Schneider Electric's functional requirements. The filter mesh, grid, and frame are manufactured as one piece.

Using 3D printing for the metal filter opens up enormous potential for applications in the industry.

- Clear cost advantages in serial production
- Fast time to market
- Innovative features
- Flexible adaptation of products and components to customer requirements

After just eight weeks, GKN Additive was able to provide functional sample parts for validation testing.

"With metal binder jetting [MBJ], the process is the same for sample parts and series production," explains Stefan Hundrieser, GPC manager additive manufacturing. "This is a decisive advantage over other manufacturing technologies, especially compared to conventional rapid prototyping. Sample parts are usually produced in a different process, and there is always uncertainty about the extent to which the samples represent the later series parts. Metal binder jetting is not limited to prototype or low-volume production. Even the sample parts have almost the exact specifications as the finished series parts."

Design for 'Sintered AM': Impetus for Development

The challenge in this project was to set up a robust, profitable series production within a short time. To do so, the entire process had to be coordinated and optimized. This included achieving maximum "part density" in the design space: creating the component to be as compact as possible so it could be produced cost-effectively. After all, the more compact the product, the smaller the space required in the 3D printer and sintering furnace — and, as a result, the lower the costs.

"Sinter-based additive manufacturing — or 'sintered AM' as we call it — requires enormous know-how. This is precisely where our expertise lies," says Hundrieser.

GKN Additive was able to start series production of the filters a mere nine months after the initial contact with Schneider Electric. For this purpose, the binder jetting process was connected to all systems (including logistics, production planning, and quality assurance) at the GKN plant in Bad Langensalza, Germany, which produces mass quantities for automotive and other industries. This created the ideal conditions for highly efficient process development.

Production was carried out in a three-shift operation with three binder jetting printers — three curing stations and a sintering furnace modified for the MBJ process, which can handle up to six printers. This way, up to 1,300 parts per month could be produced in a short time and more than 5,000 parts delivered for the pilot series.

Another advantage of the binder jetting process: The results of process optimizations, such as printing parameters or design adjustments, can be quickly evaluated and integrated into the next development step. A special flow test ensures that all parts supplied meet the required specifications.

"The joint project with GKN Additive and HP has completely convinced us of the sinter additive process," confirms Thomas Rivoire, industrialization leader at Schneider Electric. "Thanks to GKN Additive's tremendous know-how, we benefit from a highly innovative and flexible process with clear cost advantages in volume production."

Dr. Guillaume Fribourg, additive manufacturing expert at Schneider Electric, adds, "In addition, the redesigned filters feature significant improvements: increased stiffness which results in higher efficiency and easier integration. However, the key benefit is for our customers; it can allow [us] to reduce the size of the cabinets by 20 to 30 percent, thus reducing the global electrical switchgear footprint and, as a consequence, the related material consumption, including copper busbars."

Enormous Potential for Other Industries

Industrial companies from all sectors can benefit from these advantages, especially if they are under high pressure to innovate and are reaching their limits with conventional technologies.

"There are still millions of possible applications and project ideas to be discovered," Hundrieser concludes.

As a global industry partner, GKN Additive understands the needs and processes of customers seeking solutions for even the most challenging of projects to continue leading the charge in the additive manufacturing field.

Find out how GKN Additive can take your product from prototype to production. Contact us at (877) 835-6170 or hello@forecast3d.com.

Sinter-Based AM Production Process

1. 3D metal printing with binder jetting: In binder jetting, a liquid binder is applied to metal powder. This is done in two steps that are constantly repeated so the layers of material combine to form the desired part.

- **i. Application of powder:** A thin layer of powder is applied by a recoater in the work area. The powder is designed to provide fast and uniform layer distribution.
- **ii. Binder application:** Thousands of nozzles in the print head place binder droplets precisely at the points in the powder bed that determine the part geometry.

2. Curing: The polymers are cured to increase the strength of the green parts and enable safe handling.

3. De-powdering: Loose powder particles are removed from the surface of the green part.

4. Sintering: The green parts are sintered at temperatures below the melting point. During this process, metal particles are bound by atomic diffusion at the surface to form a matrix that can reach up to 98 percent solid density. The remaining binders decompose.

5. Finishing: Once products have cooled after sintering, they can undergo all the usual machining and surface treatments for solid steel parts.

Front Cover
Filters created for Schneider Electric using Metal Binder Jetting (MBJ)

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