Q.BIG 3D

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▪ Additive manufacturing for large-volume 3D plastic components using 3D extrusion printing (VFGF process)

First Backnanger Innovation and Technology Forum at Q.BIG 3D

● “Premium League of 3D printing” forum: Ten technology clusters of the “heavyweight class of 3D printing” exemplify filament-free 3D printing of large volume components

● New level of 3D extrusion printing for large-volume components using plastic granulate material as an alternative to injection molding

● New horizons for cost-effectiveness, added value and sustainability thanks to the VFGF process (Variable Fused Granulate Fabrication) in additive manufaturing

● In focus for large volume 3D extrusion printing: Rapid build speeds, high quality surface finishes and high levels of dimensional tolerances with constant gap sizes

Backnang (Germany), 27.09.2024: Size matters! The 3D printing industry has demonstrated its high potential for manufacturing strategies for large-volume components. Additive manufacturing of oversized plastic parts offers enormous advantages for tool-free production of small and medium-sized production series. The key to this is the VFGF (Variable Fused Granulate Fabrication) process from Q.BIG 3D. At the first Backnang Innovation and Technology Forum at Q.BIG 3D, the 3D printing machine manufacturer, together with ten partners from industry and research, provided information on the latest developments in the field of 3D printing large-volume components with plastic granulate material.

Tool-free production with an industrial large-format 3D extrusion printer opens up time-to-market strategies for users. The elimination of tool costs and new component geometry strategies in engineering design combine with extremely short amortization periods for this system technology. Compared to alternative AM strategies, such as

FDM printing systems, the key advantage is the use of commercially available granules without filaments. The range of applications is enormous and even very large components and assemblies can be cost-effectively printed. One example is the additive manufacturing of the 3D cockpit of a helicopter simulator at Murtfeldt Additive Solution using a Queen 1 system from Q.BIG 3D. The dimensions of the cockpit are 2,260 mm (x), 1,780 mm (y) and 1,705 mm (z). The weight is just 200 kg due to the resource-friendly lightweight construction that the 3D printing process makes possible. Prof. Dr. Thomas Brinkmann (Impetus Plastics Engineering): “Our engineering company sees enormous potential for product development with large-format 3D printing. This also applies to lightweight construction, bionics and resource conservation. Above all, however, the VFGF process is an accelerator of the Industry 4.0 approach.”

Keynote speeches at the first Backnanger Innovation and Technology Forum

At the forum, keynote speeches were given by experts from ten companies and organizations: HZG Group, Naddcon, Trinkle 3D, Q.BIG 3D, DMRC, Alfred Kärcher, Impetus Plastics Engineering, DIPROmat, LuxYours, Amecos, 3D Industrie, Weisser Spulenkörper and Fraunhofer IPA. The keynote speakers from the “heavyweight class” of 3D printing explained the high potential of this manufacturing strategy. The forum thus reflected a cross-section of the large-format 3D printing industry: machine suppliers, consultants, material experts, users and research. Dennis Herrmann, Managing Director of Q.BIG 3D: “We are producing the future. 3D material extrusion using the VFGF process is pushing the boundaries of what is feasible and enabling a whole new level of profitability and amortization.”

New-found flexibility thanks to large-format 3D printing with the VFGF process

Previous limitations of conventional manufacturing strategies can be successfully overcome with VFGF system technology. For example, classic mold-based processes, especially for large-volume components, incur high tool costs combined with long lead times. What's more, classic FDM (Fused Deposition Modeling) printers are usually unable to produce large-volume 3D components. In this case, build rates are uneconomical and the filament used often costs 7 times more per kg than granulate material. Johannes Lutz, CEO of 3D Industrie GmbH: "The demand in the market for large-volume, additively manufactured components has been increasing steadily for months. A VFGF printer offers significant cost advantages for the customer when it comes to the production of large components, as well as better profitability and amortization for the 3D processor. This combination is an excellent Win-Win situation for service providers and end customers."

Note to editors: Please see event program attached for more background information.

Picture captions

Picture caption 1: Cockpit conversion kit as a modular structure with high surface quality and high dimensional accuracy; the gap tolerances are also maintained to specifications on the fully functional door.

Picture caption 2: The variable nozzle control enables rapid build speeds since the nozzle discharge rate is selectively adjusted to the geometry of the 3D components.

Picture caption 3: VFGF extrusion print head with variable nozzle diameter enables targeted component build approaches (schematic diagram).

Picture caption 4: Dennis Herrmann, Managing Director of Q.BIG 3D: “We are producing the future. 3D material extrusion using the VFGF process is pushing the boundaries of what is feasible and enabling a whole new level of profitability and amortization.”

Picture caption 5: Additive manufacturing pioneer with over 400 patents: Frank Herzog (founder of the HZG Group, former CEO of Concept Laser) at the Innovation Forum

Picture caption 6: Prof. Dr. Thomas Brinkmann (Impetus Plastics Engineering): “Our engineering company sees enormous potential for product development in the field of large-format 3D printing. This also applies to lightweight construction, bionics and

resource conservation. Above all, however, the VFGF process is an accelerator of the Industry 4.0 approach."

Picture caption 7: Johannes Lutz, CEO of 3D Industrie GmbH: "The demand in the market for large-volume, additively manufactured components has been increasing steadily for months. A VFGF printer offers significant cost advantages for the customer when it comes to the production of large components, as well as better profitability and amortization for the 3D processor. This combination is an excellent Win-Win situation for service providers and end customers."

Picture caption 8: Visitors at the first Innovation and Technology Forum at Q.Big 3D.

Picture Caption 9: The speakers at the Innovation Forum at Q.BIG 3D: Siegfried Knüpfer (partner and managing director at Q.BIG 3D), Frank Herzog (founder of the HZG Group, formerly CEO of Concept Laser), Prof. Dr. Thomas Brinkmann (Impetus Plastics Engineering), Christian Steinhage (CEO Naddcon), Christian Elsner (DMRC), Katja and Dennis Herrmann (founders of Q.BIG 3D), Dr. Melanie Keuper (Alfred Kärcher SE & Co. KG), Uwe Stenglin (Dipromat), Florian Pfefferkorn (LuxYours), Andreas Tulay (Amecos), Maximilian Ruoff (Weisser Spulenkörper), Johannes Lutz (CEO 3D Industrie) and Felix Dörr (Trinkle 3D) (from left to right)

All image sources: Q.BIG 3D GmbH, Backnang (Germany) (unless otherwise stated).

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The **VFGF** (**V**ariable **F**used **G**ranular **F**abrication) **additive manufacturing process** enables the production of **large-volume 3D components from plastic granulates without filaments**. A characteristic of this 3D extrusion process is the ability to use a **variable nozzle diameter**. The VFGF process enables precision printing with high resolution in places where fine details are required, such as on the outer surfaces of a component. At the same time, structures on the inside or areas where the resolution is less relevant can be printed more coarsely and therefore faster in a so-called **turbo mode**. This flexibility of the process allows **high build speeds** of the 3D components.

The **VFGF process combines speed with precision**, which is particularly advantageous for large-volume printing. It thus optimizes the 3D printing process by combining quality with efficiency and optimizing the time-to-market approach. The VFGF process uses **adapted process algorithms (predictive flow algorithm)** to build up a component at the right time, in the right position with the right amount of material. This makes it possible to print even complex components utilizing undercuts with the help of support structures.

3D printing with commercially available plastic granulates without filaments makes it possible to process technical plastics with **near-series production properties at very low unit costs.** Melting the granulate in a specially developed **screw extruder (3D-Material-Extrusion)** enables higher throughputs, which significantly reduce printing time. **Fiber-filled materials** with high dimensional stability as well as **elastic materials** can also be printed. The possibility of producing large-volume components

without tooling costs opens up new horizons for users in terms of **unit costs and amortization of the investment** (usually in less than 12 months) to **increase added value**.

The process is suitable for rapid prototyping, replacement components and series production.

The VFGF process combines sustainability aspects with high cost-effectiveness. Compared to standard 3D printing processes, there are **significant cost advantages regarding material usage and an increase in build speeds of up to a factor of 100.**

Q.BIG 3D: An Overview

Q.BIG 3D GmbH, based in Backnang, Germany, is a young technology and service company specializing in the construction of 3D-printing systems. Founded in 2019 by two graduates of Aalen University, Dennis and Katja Herrmann, the company is a strategic partner of Manz AG in Reutlingen, Germany and the HZG Group in Coburg, Germany as investors. 3D system technology from Q.BIG 3D enables the production of large-volume 3D components (> 200 kg) using commercially available plastic granulates without filaments (such as PP, PA, ABS, TPE, TPU, PLA containing up to 25% GFRP).

It is based on the VFGF process, a 3D extrusion process that combines high precision with high build speeds. The QUEEN 1 system offers a build space which is 1,700 mm wide / 1,050 mm high / 1,050 mm deep. Maximum process speed is 500 mm/s. The dynamic output of the system is 0.15 – 2.0 kg/h.

Applications range from functional and structural components for systems and mechanical engineering, commercial vehicles and agricultural machinery in the automotive sector, tank solutions, energy technology, right up to ergonomic and medical technology products.

In addition to system technology, the Q.BIG 3D team offers user support services. These include design consulting, process-optimized slicing, application technology support, optimization of rework in post-processing, system training as well as quality assurance tasks.

The company has received numerous awards for its innovative VFGF technology, most recently the Innovation Award of the East Württemberg Economic Region in November 2021.

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